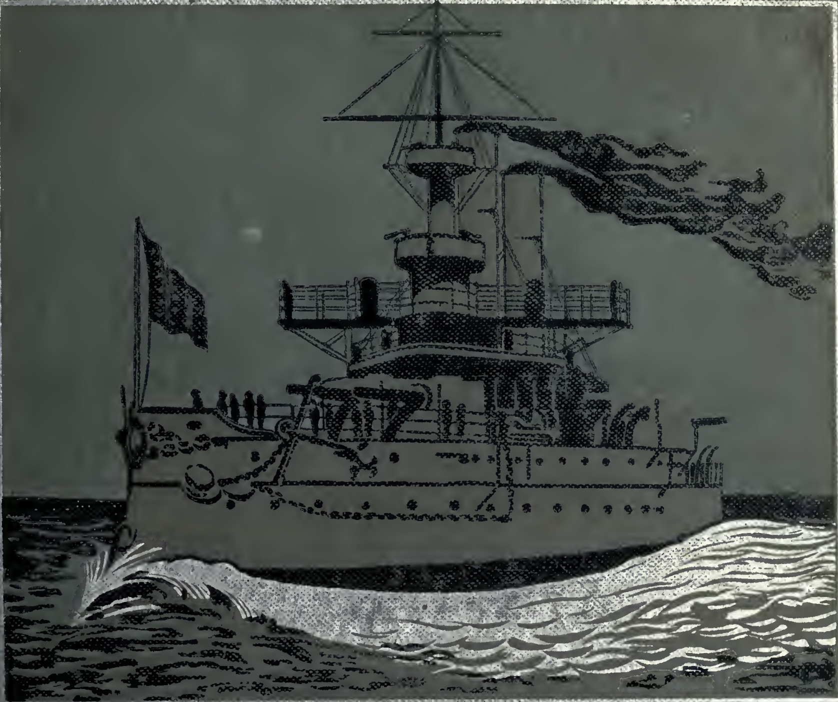

THE NATION'S NAVY


MAP OF THE
WEST INDIES
SCALE OF MILES
0 25 50 100 200 300
GULF OF MEXICO
ATLANTIC OCEAN
CARIBBEAN SEA
PACIFIC OCEAN
FLORIDA
C. Sable
Key West
DRY TORTUGAS
Strait of Florida
BAHAMA ISLANDS
ANDROS ISLAND
Nassau
ELEUTHERA I
Exuma Sd.
EXUMA I.
LONG I.
SAN SALVADOR OR CAT I.
WATLINGS I.
CROOKED I.
ACKLIN I.
Caicos Passage
GR. INAUGUA
Old Bahama Ch.
CUBA
HAVANA
Mariel
Bahia Honda
Pinar del Rio
Mantua
C.S.Antonio
C. Corrientes
Pt. Llana
Pt. Gorda
C. Frances
I. DE PINOS
Matanzas
C. Hicacos
Colon
Sta. Clara
Cienfuegos
Trinidad
Sta. Espiritu
S. Geronimo
Gertrudis
Moron
Pto.Principe
Sta.Cruz
Nuevitas
La Tunas
Holguin
Mayari
Pt. Mangle
Baracoa
Maysi Pt.
Cabo de Cruz
Santiago de Cuba
Sta. Catalina
St.Anns T.
GRAND CAYMAN
JAMAICA
Negril Pt.
Kingston
Portland Pt.
Morant Pt.
Windward Passage
Mole St. Nicolas
Cap Haitien
C. Isabelique
Vieux Cap
B. Ecossaise
St.Marc
GONAIVE I.
Jeremie
C. Tiburon
Port au Prince
HAITI
STO. DOMINGO
Sto.Domingo
C. Engano
Mona Passage
PORTO RICO
San Juan
San German
Guayama
VIRGIN IS.
ST.THOMAS
SANTA CRUZ
ST.CHRISTOPHER
BARBUDA
ANTIGUA
MONTSERRAT
GUADELOUPE
DOMINICA
MARTINIQUE
ST.LUCIA
ST.VINCENT
BARBADOS
GRENADA
TRINIDAD
CURACAO
BUEN AYRE
TORTUGA
Cumana
Barcelona
Caracas
Valencia
VENEZUELA
G. of Venezuela
Maracaibo
Pt. Gallinas
Rio Hacha
Santa Maria
COLOMBIA
MEXICO
YUCATAN
Progreso
Merida
Valladolid
Jungle Pt.
C. Catoche
COZUMEL
Yucatan Channel
Ascension Bay
Calentura Pt.
Belize
TURNEFF
BELIZE
Flores
GUATEMALA
Coban
Honduras Bay
C. Honduras
Brewer Lagoon
Caratasks Lagoon
Truxillo
HONDURAS
Comayagua
San Salvador
C. Gracias
Blackman Bluff
Bay of Fonseca
Segovia
Boaco
NICARAGUA
Managua
L. Managua
Pearl Keys Pt.
Blewfields
L. Nicaragua
Greytown
COSTA RICA
San Jose
Port Culebra
C. Blanco
90
85
80
75
70
65
25
20
15
10

The Nation's Navy

OUR SHIPS AND THEIR ACHIEVEMENTS

By

Charles Morris

Philadelphia
J. B. Lippincott Company
1898

PREFACE.

The past half-century has witnessed a revolution in all things connected with naval warfare. The war-ship of the past has vanished and another and stronger has taken its place. The wooden walls of the ships of our ancestors have been replaced by walls of steel, the swelling sail by the whirling screw, St. Elmo's fire by the search-light, the seaman by the sea-mechanic, and the reefer of the sail by the heaver of coal. In short, in comparing the navy of the past with that of the present, we feel constrained to quote from Shakespeare—with a slight difference in wording:

> "Nothing of it that can fade
> But has suffered a sea change
> Into something new and strange."

To-day the navy of the United States stands strongly in evidence. There is nothing else which fills so large a space in the world's eye. It is the one subject about which all our people talk by day and dream by night; in which they feel an abiding interest and take a patriotic pride. Ten years ago this was not the case. Then we had no navy, other than a museum of antiquities. To-day our navy is, for its size, perhaps the finest in the world. Ten years from to-day it may take rank with the largest and strongest in the world. This country long held back from the work of naval construction that was actively pursued abroad, but has now entered into it with all the American energy and inventive ability, and is giving lessons to, instead

of receiving lessons from, the maritime nations of Europe.

It is this evolution of an American navy with which we here propose to deal, to give its history in war and peace, its development, its present condition, with descriptions of its new vessels and their equipment for offence and defence; in short, to present a detailed account of the whole make-up of the floating engines of destruction which now represent our country upon the seas.

It is a timely season for such a work, now that a war has arisen in which our navy plays a leading part, and plays it so well that our people regard with admiration their ships of war, and are eager to know what manner of thing this is that we now call a battle-ship or a cruiser; what is meant by such new terms as conning-tower, barbette, rapid-fire gun, submarine boat, and the like; and the significance of the many matters that have to do with modern naval science and engineering. These are the questions which this book is written to answer, not in technical terms, but in plain and simple language, which all who read may understand. It is offered to the American public in the hope that it may fulfil its promise in this respect.

It may be proper to say concerning its illustrations that they have been selected with the purpose of presenting typical examples of our different classes of war-vessels, one of the best of each type being chosen, and also of showing the various elements of existing naval construction, with the view that the illustrations may serve as a useful and convenient commentary upon the text. Thanks are hereby returned to the Scientific American Company for the privilege of reproducing the cut entitled "The invulnerable floating fort within the outer walls of modern battle-ships."

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THE NATION'S NAVY.

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PART I.

History of the American Navy.

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CHAPTER I.

THE NAVY IN THE REVOLUTION.

THE navy of the United States of America came legally into existence on Friday, December 22, 1775, by act of the Continental Congress on that date. Its record has been one of exceptional brilliancy. In all its career, during the century and a quarter of its existence, it has scarcely met with a reverse, its story being one of almost unbroken victory. And its triumphs were gained, in its earlier days, over the far superior sea power of the island kingdom beyond the sea, whose proud boast, "Britannia rules the waves," failed to be sustained against the strength and daring of American ships and sailors.

The first ocean conflict in the history of the American republic took place at the port of Machias, Maine, May 11, 1775, instigated by the tidings of the battle of Lexington, which in those slow days took three weeks to reach that point, a few hundred miles to the north. In these more rapid times a day's delay in receiving news from Manila, on the other side of the

world, seems a hardship difficult to be borne. In the harbor at Machias lay an armed British schooner, the Margaretta, with two sloops loading with lumber on British account. A party of the townsmen, filled with patriotic ardor, and led by Jeremiah O'Brien, "an athletic gallant man," determined to make a prize of this representative of the British navy, and began operations by trying to seize her captain at church. Captain Moore, in alarm, fled to his vessel, fired several shots over the town by way of warning, and then, not liking the looks of things on shore, weighed anchor and stood down-stream.

The next morning the townsmen took possession of one of the sloops and stood out in chase. The crew of haymakers and woodsmen were armed for the main part with pitchforks and axes, to which they added twenty guns, with three rounds of ammunition for each. Thus provided for warfare, and with a northwest wind in their sail, these thirty-five bold patriots stood away to capture an armed vessel on the high seas.

It was a daring venture, but Captain Moore's lack of courage gave it promise of success. In his haste to escape he carried away his boom, and was obliged to obtain another by robbing a merchant vessel which he found at anchor. This gave the sloop, which was the faster sailer of the two, an opportunity to come up, and the captain of the Margaretta soon found himself forced to stop and fight. His vessel was armed with four 6-pounders and twenty swivels, and his crew outnumbered that of the sloop, but the element of resolution seemed sadly wanting. After a brief exchange of shots the vessels came together with a crash,

and the men of Machias, axe and pitchfork in hand, leaped to the schooner's deck. The British crew, thus brought to the touch, fought with some bravery, but Captain Moore soon fell dead and his men surrendered. In all, twenty men were killed and wounded in this short but sharp fight.

And now, arming his sloop with the captured cannon and ammunition, O'Brien put to sea, and soon sent several prizes in to Machias. Other daring patriots quickly followed his example, their boldness and success so exasperating Admiral Graves, the commander of the British fleet on the coast, that he took a dastardly step of revenge. Four armed vessels were sent to bombard Falmouth (now Portland), Maine, and did so with such ruthless cruelty that nearly the whole town was reduced to ashes, and more than a thousand of the inhabitants, men, women, and children, were driven out shelterless to endure the cold of the fierce Maine winter, then near at hand.

This act of barbarism is of importance in connection with the history of the American navy. It aroused wide-spread indignation, and instigated the Congress to commission colonial cruisers and privateers, to order the confiscation of prizes, and to take active steps towards the creation of a navy. Thirteen ships, in accordance with the number of the colonies, were ordered to be built, five of them to carry thirty-two guns; five, twenty-eight guns, and three, twenty-four guns. But that a naval force might be obtained without delay, several vessels were purchased,—two ships, renamed the Alfred and the Columbus; three brigs, the Andrea Doria, the Cabot, and the Providence; two schooners, the Wasp and the Fly; and a sloop,

the Hornet. The final act, that of appointing officers to the ships obtained, which completed the formation of the navy, was taken on the date named, December 22, 1775.

Esek Hopkins, brother of the governor of Rhode Island, a warrior who had seen much more service on shore than at sea, was made commander-in-chief of the navy. (He was the only one to bear this title, which indicated that he was equal in rank with Washington.) Dudley Saltonstall was appointed captain of the Alfred, Abraham Whipple of the Columbus, Nicholas Biddle of the Andrea Doria, and John B. Hopkins of the Cabot. Of the minor officers, it will suffice to name John Paul Jones, first lieutenant of the Alfred, who was destined to become the most notable figure in the naval history of the United States.

One ceremony remained to be performed before the new navy could come properly into service, the raising of the flag. This took place immediately after the commissioning of the officers by Congress, perhaps on the same day, though the date is not mentioned. Commodore Hopkins and his officers made their way from the foot of Walnut Street, Philadelphia, to the fleet, which lay anchored in the Delaware, while a throng of people gathered along the river shore, and the shipping in the stream was bright with bunting and crowded with spectators.

Reaching the Alfred, the flag-ship of the squadron, the commodore took his station on the quarter-deck, surrounded by his officers, while the sailors of the crew, who had been called aft by the shrill whistle of the boatswain, stood expectant in the vessel's waist. A great flag of yellow silk was made fast to the mizzen

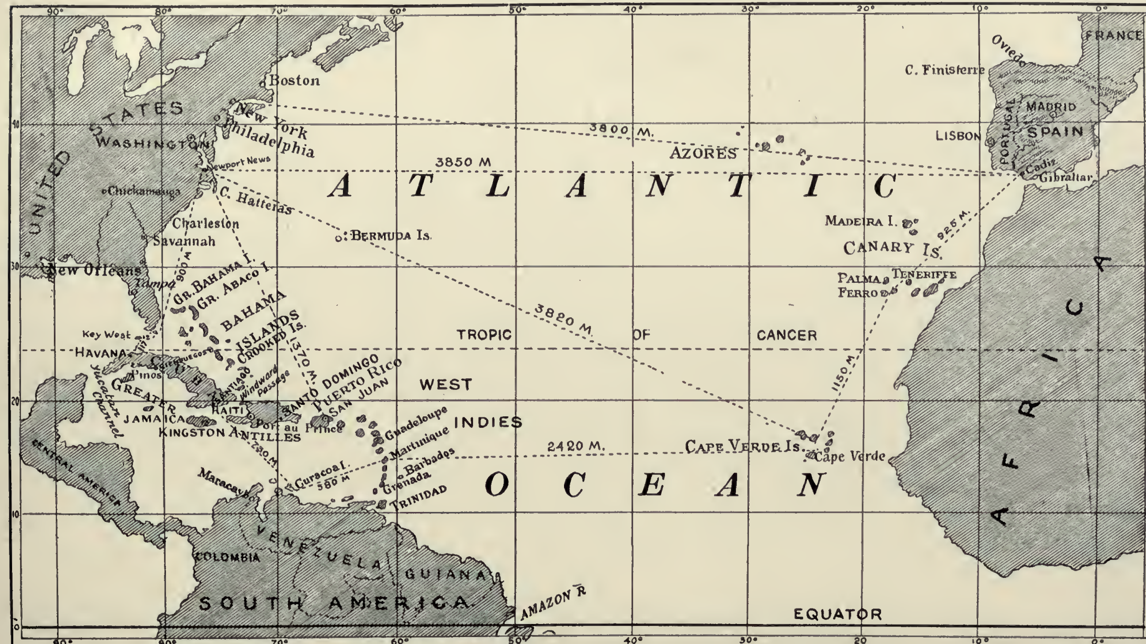
signal halliards, when, at a gesture from the commodore, Lieutenant John Paul Jones grasped the halliards and, amid the roar of cannon and the cheers of enthusiastic patriots, raised the standard to the peak. On unfolding, its floating width displayed the figure of a green pine-tree, at whose foot lay coiled a rattlesnake, with the significant warning, "DON'T TREAD ON ME." Following this was set the commodore's pennant, and then the banner of the colonial union, the same that floated over Washington's camp at Boston, a flag of thirteen stripes, alternately red and white, with the British union jack in the field,—the flag a compromise as yet between liberty and loyalty. The resolutions of Congress were then read, and the first fleet of the American navy was declared in commission.

The fleet thus constituted seemed ludicrously small in comparison with the naval strength of the foe. The flag-ship mounted twenty 9-pounders, with four smaller guns, probably 4-pounders, and the total fleet carried but about one hundred and ten guns, of which only forty threw balls of as much as nine pounds weight. The enemy, on the contrary, had then on our coast or ordered hither seventy-eight ships, carrying two thousand and seventy-eight guns, of which at least five hundred were 18-pounders or heavier. And the British ships were manned by trained seamen, those of America mostly by landsmen or men destitute of naval training and discipline. It seemed like a dwarf contending with a giant, yet the captains of America were to prove that they could make for themselves a good record even against such disproportion.

The first service ordered for the fleet was against Lord Dunsmore, late royal governor of Virginia, who was then afloat as a fugitive and engaged in raids along the shores of Chesapeake Bay. But Commodore Hopkins disregarded his orders and sailed instead to the Bahama Islands, with the purpose of attacking New Providence, which he had heard was poorly defended and contained a large quantity of military stores. This expedition proved successful. The forts were carried by assault, a hundred cannon and valuable stores were captured, and the ships, heavily laden with the spoils of war, set sail for the north on March 17, 1776, the day on which the British army and fleet were leaving Boston in haste and confusion.

Two weeks later the vessels of the fleet were making their way at midnight through the waters between Block Island and the mainland, when a large, strange ship suddenly appeared in their midst. It was the British twenty-gun sloop of war Glasgow, with a crew of one hundred and fifty men. The Americans, untrained in their duties, were keeping but a careless watch, and a hail from the Cabot was answered by a broadside from the stranger which came like a shock to the sleepy crews. Thus began the first naval conflict in the history of the American navy. For an hour the battle was kept up, the guns of the Glasgow being much the better served. Then, finding the contest too hot for her, she took to flight, pursued in vain by the heavily laden American ships, which she easily outsailed.

The escape of the Glasgow brought an end to Commodore Hopkins's naval career. He was severely


UNITED STATES
WASHINGTON
Boston
New York
Philadelphia
Newport News
Chickamauga
C. Hatteras
Charleston
Savannah
New Orleans
Tampa
900 M
Key West
HAVANA
Pinos
GR. BAHAMA I.
GR. ABACO I.
BAHAMA ISLANDS
CROOKED Is.
1370 M.
Windward Passage
GREATER ANTILLES
JAMAICA
KINGSTON
HAITI
Port au Prince
SANTO DOMINGO
PUERTO RICO
SAN JUAN
Yucatan Channel
CENTRAL AMERICA
Maracaybo
Curacoa I.
580 M
Guadeloupe
Martinique
Barbados
Grenada
TRINIDAD
WEST INDIES
COLOMBIA
VENEZUELA
GUIANA
SOUTH AMERICA
AMAZON R
BERMUDA Is.
3850 M
3800 M.
3820 M.
2420 M.
1150 M.
925 M.
ATLANTIC
OCEAN
TROPIC OF CANCER
EQUATOR
AZORES
MADEIRA I.
CANARY IS.
PALMA
FERRO
TENERIFFE
CAPE VERDE Is.
Cape Verde
C. Finisterre
Oviedo
FRANCE
MADRID
SPAIN
PORTUGAL
LISBON
Cadiz
Gibraltar
AFRICA
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°

blamed for his failure to take this vessel, his good service at New Providence being forgotten in the popular anger, which blazed out in its usual hasty fashion. He was relieved temporarily of his command, and his dilatory action when restored led to his permanent removal. This first American commodore was not wanting in bravery, but he was an old man, his principal service had been on shore, and he was destitute of experience in the command of a fleet.

Its battle with the Glasgow was the first and last occasion on which the American squadron acted together as a fleet. But during the remainder of the year 1776 its vessels did good service independently, capturing and sending into port a large number of prizes. The first naval battle on even terms took place between the Andrea Doria, then commanded by Captain Isaiah Robinson, and the British brig Racehorse. Its result was the more significant from the fact that the Racehorse had been sent out expressly to capture the Yankee brig. The battle took place in the West Indies, off the western end of Porto Rico, and continued for two hours, at the end of which the Racehorse struck her colors to the brig she had proudly expected to bring in as a prize. She was safely conveyed to the Delaware by Captain Robinson and his crew.

On May 10, 1776, Paul Jones was given his first independent command, being made acting captain of the twelve-gun brig Providence. His first employment was to carry troops and convoy merchantmen, in which service he was so successful in eluding the many cruisers of the enemy that Congress promoted

him in August to the full rank of captain, with orders to cruise for prizes between Boston and the Delaware.

Captain Jones quickly showed the metal of which he was made. On September 1, 1776, he sighted a fleet of five vessels, and began to beat up towards the largest, believing it to be a merchantman. He was close at hand before he discovered his mistake. It proved to be the frigate Solebay, of twenty-eight guns. Jones at once bore hastily away, but the frigate pursued, gaining slowly, until, after a four-hours' run, it was less than one hundred yards away.

A few minutes more, and a broadside from its powerful antagonist might have swept the venturesome little brig from the sea. But Captain Jones was equal to the occasion. He had quietly prepared for a daring manœuvre. Suddenly the helm was put hard up and the little craft turned and dashed directly across the frigate's bows. As she did so the flag of the republic was run up to the truck and a broadside swept the Solebay's deck. In a moment more studding sails were set on both sides and the Providence dashed away before the breeze, showing her heels to the frigate's astonished crew. Recovering from their confusion, they sent more than a hundred balls in her wake, but not one took effect, and the Providence, with swelling sails and the best of the wind, dropped her great antagonist in the rear.

We may briefly describe the remainder of Captain Jones's cruise. He was again chased by a British frigate, the Milford, took sixteen prizes and destroyed a number of vessels, and later (then in command of the Alfred) captured the brig Mellish, laden with army supplies, among them ten thousand complete uni-

forms, a most valuable prize for the American army. On his way home, accompanied by a small fleet of prizes, he was a second time chased by the Milford. As he had proved his power to outsail her, he shrewdly led her off from the course of the prizes at night, and the next day gave her the slip, arriving at Boston December 15, whither his prizes had preceded him. He was repaid for his service, through the jealousy of Commodore Hopkins, who was still in control of the fleet, and did not relish the activity of his subordinate, by being ordered back to the little brig Providence.

Meanwhile, an important naval battle had taken place on Lake Champlain. General Carleton, with a fleet of twenty-five vessels, armed with eighty-nine guns varying from 6- to 24-pounders, was descending the lake with the purpose of cutting off New England from the remainder of the country. To meet him Benedict Arnold had hastily built a fleet, which consisted of fifteen small vessels, armed with eighty-eight guns of inferior caliber to those of the British fleet, while to the one thousand British seamen he opposed seven hundred untrained landsmen, hastily gathered to man his rapidly built vessels. But Arnold was a host in himself, and his unflinching resolution went far to make up for the deficiencies in his fleet.

Arnold's flag-ship, the Congress, was an eight-gun galley moved by oars, while his largest vessel, the twelve-gun schooner Royal Savage, compared but poorly with the three-hundred-ton ship Inflexible, with her eighteen 12-pounders, the flag-ship of the British fleet. At daybreak on the morning of October 11, 1776, Arnold's little fleet lay at anchor across the north end of the strait between Valcour Island and

the mainland. With the rising sun the British fleet came gallantly down the bay before a fresh wind, driving past the island without discovering that an antagonist lay hidden there. Then, seeing the hostile vessels, and fearing to expose his rear to the Americans, Carleton wore round, and worked back against the wind to attack the waiting fleet.

It was eleven o'clock before the battle began, and it soon brought disaster to the Americans, for the Royal Savage, disabled by shot, ran aground, and was set on fire and abandoned by her crew, who escaped to the island's shores. And now the engagement grew fierce and fast, the British, in addition to their superior force, being aided by Indians on both the main and the island, their flank attack greatly annoying the Americans at their guns. Yet the gallant farmers, inspired by their valorous leader, fought on resolutely for hours, until night sank over the scene. By that time the Congress and the Washington were riddled with shot holes and the Philadelphia was in such a state that she sank within an hour after the end of the fight.

The Americans had damaged the enemy, but they had lost heavily in men and ships, and, still worse, had used up nearly all their ammunition. If he remained where he was destruction or capture was certain in the morning, and Arnold resolved to slip away and seek shelter under the guns of Crown Point or Ticonderoga. The night was dark and stormy, with a northerly gale, and, weighing anchor, the ships stood down the channel, passing through the enemy's line unseen. At daylight of the next morning they were

ten miles away, and had stopped to repair damages under the lee of Schuyler Island.

Here two gondolas, wounded past repair, were sunk, and the remaining vessels were patched up to enable them to keep afloat. But the wind had changed and their onward flight was checked, the British ships coming up while they were still some leagues distant from Crown Point. Battle under the circumstances seemed madness, but Arnold did not know how to surrender, and fought on with his few remaining boats until he had but a wreck beneath his feet. The shattered Washington was forced to surrender, but the few galleys left were run ashore and set on fire, Arnold covering them in the Congress until their crews were safe ashore. Then he ran his flag-ship aground, and stood guard while the crew fired her, "remaining on board until she was in flames, lest the enemy should get possession and strike his flag, which was kept flying to the last."

The Congress being past saving, Arnold leaped overboard and waded ashore, where he formed his men in order and marched away through the forest to Crown Point. It was one of the most gallant contests in the naval history of the United States, and the defeat had all the effect of a victory, since Carleton was in no condition to continue his enterprise, and the proposed invasion of the valley of the Hudson came to an end.

In the autumn of 1776 the American flag was first carried across the Atlantic, Captain Wickes, of the sixteen-gun brig Reprisal, capturing two prizes while conveying Benjamin Franklin across the ocean to France. The brig Lexington, Captain Johnson, was

sent across in the spring of 1777. These two vessels captured numerous prizes, though both met with misfortune in the end. The Reprisal foundered during her return to America, and the Lexington was captured by the cutter Alert after having expended all her ammunition. Two other ships, the Surprise and the Revenge, took part in the harrying of British trade in the home seas, and with such success that marine insurance greatly rose in London and French ships found abundant cargoes in the Thames. American sailors had made the seas unsafe for British merchantmen.

On June 14, 1777, Paul Jones, who had been somewhat shabbily treated by Commodore Hopkins and by Congress, was appointed captain of the Ranger, a new eighteen-gun ship built at Portsmouth, New Hampshire. It is said to have been the first ship to fling to the breeze the new American flag, the stars and stripes, recently adopted. The Ranger sought her prey in British waters, but was delayed in sailing, and did not reach Nantes, France, until December, whence she sailed in February, 1778, for Quiberon Bay in convoy of some American merchantmen. Here lay a French fleet, and the new flag of the United States received its first salute by a foreign power. On April 10 Captain Jones left the harbor of Brest and steered straight for the coast of England, to begin that brilliant career which has given him such renown in American history.

He was not long in astonishing the English by his daring. In the port of Whitehaven lay two hundred and twenty vessels, large and small. These he proposed to burn, as a warning to the enemy to cease

their burnings on the American coast. With a boat's crew of fifteen men he easily captured the two forts that guarded the harbor, and attempted to carry out his plan, setting on fire a large ship in the midst of the fleet. But the enemy had now mustered in force, and he was obliged to withdraw before much damage had been done. His next project was as bold as this, it being no less daring a scheme than to take prisoner an English earl in his own castle, to be held as a hostage for the better treatment of American prisoners. Fortunately for the Earl of Selkirk, whose house was captured, he was absent from home, and the sailors contented themselves with carrying off his silverware. This was, years afterwards, returned by Jones to the earl with his compliments.

On April 24 the Ranger came into contact with the Drake, a twenty-gun British man-of-war, off the port of Belfast, Ireland. The Drake was a larger ship than her antagonist, but Captain Jones boldly attacked, hoisting the stars and stripes, the first time the new American standard had been seen in a naval battle. The conflict was a sharp one. The sails and rigging of the Drake were soon in tatters, her flag was twice shot away, her captain fell dead and her first lieutenant mortally wounded, and at length, just as the sun was sinking behind the Irish hills, a cry for quarter was heard and the British ship surrendered. Forty-two of her men had been killed and wounded; the Ranger lost but eight.

While these events were taking place in British waters, little of importance in naval history occurred on the American coast. Of naval battles, the most notable was that between the thirty-two-gun frigate

Randolph, the first of those built by Congress, and the British sixty-four-gun ship of the line Yarmouth, in West Indian waters. Captain Nicholas Biddle, in command of the Randolph, fought his thirty-two small guns against the sixty-four large ones for a full hour, at the end of which time a shot penetrated the Randolph's magazine and blew her into fragments. Of her three hundred and fifteen men, only four remained alive. This disaster was preceded by the loss of the thirty-two-gun frigate Hancock, which, after capturing the twenty-eight-gun frigate Fox, was surrounded by a fleet of three men-of-war and forced to surrender. Another of the new American frigates, the Virginia, ran aground in Chesapeake Bay, and her captain and crew were forced to escape in their boats from two British war-ships near by. Still another vessel was lost during the year, the Raleigh, Captain Barry, after a running fight with two British frigates. In the end the Raleigh grounded on the coast of Maine, and Barry and his men escaped in their boats. The same gallant officer, some time before, had, with twenty-seven men, boarded the British armed schooner Alert in the Delaware, and captured it with its one hundred and sixteen men and officers, sinking the schooner and two transports which it convoyed.

Of the thirteen frigates which Congress had built, only four remained at the end of 1778, some being lost, as described, and the others caught and captured in port through operations of the British army. But the surprise was that they were able to make any contest at all, for during 1778 the British fleet in American waters numbered eighty-nine, armed with two thousand five hundred and seventy-six guns, while the

Americans had, all told, fourteen ships, with three hundred and thirty-two guns.

Meanwhile, the American seas swarmed with privateers, whose bold onslaughts made havoc among British transports and merchantmen. Up to the end of 1777 the American ships of war and privateers had taken seven hundred and thirty-three prizes, of which five hundred and fifty-nine were brought into port, their value being estimated at £2,600,000. The total number of privateers is given at one hundred and seventy-three, carrying two thousand five hundred and fifty-six guns. Of these, thirty-four were captured. Of a fleet of sixty vessels from Ireland for the West Indies, no less than thirty-five were brought in by privateers. Nor did the valiant adventurers hesitate to try conclusions with ships of war. Captain Truxton, in the privateer St. James, fought off a thirty-two-gun ship that had been sent out to capture him. Captain Williams, in the Hazard, captured the better-armed brig Active, and in the twenty-gun ship Protector fought off the British thirty-two-gun frigate Thames. Captain Waters, in the Thorn, of sixteen guns, fought with two British sloops of war, the Governor Tryon, of sixteen guns, and the Sir William Erskine, of eighteen guns. After two hours of desperate fighting the Tryon struck and the Erskine drew off. But Waters pursued and compelled her to strike, the Tryon taking advantage of the opportunity to escape. The next day Waters, with but sixty men left on his vessel, met the Sparlin, of eighteen guns and ninety-seven men, and added her to his list of prizes.

We may end the story of the privateers with the

exploit of the Hyder Ali, Captain Barney, of the Pennsylvania State service, in 1782. With an armament of sixteen 6-pounders he fought and captured the British brig Monk, of sixteen 12-pounders and two long sixes; then drove ashore her consort, the Fair American; and ended by eluding the frigate Quebec, which had looked on in dismay at this American victory, while prevented by the shoals of Delaware Bay from taking part. Thus triumphantly ends the record of American privateering in the Revolutionary War.

There remains to describe the chief event in the naval history of the Revolution, the most famous event, indeed, in the naval history of the United States, the great sea-fight between the Bonhomme Richard and the Serapis. After his brilliant cruise with the Ranger, Paul Jones was long delayed by lack of funds in the treasury of the republic from obtaining a larger ship. At length there was bought for him an old East India merchantman, shapeless and unwieldy, and so worn out with long service that her timbers were in a state of dry rot. This he named, through his admiration for Franklin's "Poor Richard," the Bonhomme Richard.

Ordered to this ship on February 4, 1779, it took so long to fit her for service that it was June 19 before he was able to sail. An accident obliged him to return, and August 14 arrived before his cruise finally began. The delay enabled him to ship more than one hundred American sailors, freed by exchange from English prisons. He also added to his crew as master's mate Richard Dale, who had escaped from prison in England, and was a man of his own caliber. When he did set sail it was with a fleet, his own ship

of thirty-six guns and three consorts, the Alliance, the Pallas, and the Vengeance.

We may pass over the career of this fleet, which cruised around the British isles, meeting nothing but merchantmen, until September 23, when it came in sight of a fleet of forty-two ships off Flamborough Head. They proved, upon examination, to be merchantmen under convoy of two frigates, the Serapis, of fifty guns, and the Countess of Scarborough, of twenty-two 6-pounders. In the memorable battle that followed the Vengeance was too far away to take part, the Pallas fought with and captured the Countess of Scarborough, the Alliance, under an insubordinate French commander, took part in the fight only to do harm, and the Bonhomme Richard was left to encounter the far superior Serapis alone.

Night had fallen before the battle began. At the first fire two of the three 18-pounders on the lower deck broadside of the Bonhomme Richard burst, killing or disabling their crews, and leaving but the 12- and 9-pounders of the upper deck safe for use. The Serapis had ten 18-pounders in each battery, which in time tore the ports of her antagonist into a gaping chasm on both sides, many of the balls crossing through and falling into the sea beyond. Some of them, however, penetrated the Bonhomme Richard below the water level, and she was soon "leaking like a basket." It was in this seemingly desperate juncture of affairs that Captain Jones answered the hail of the captain of the Serapis, asking if he had surrendered, with the famous reply, "I have not yet begun to fight."

Nor was this a boast. Shortly afterwards the two

ships drifted together, and at Jones's order the jib-boom of the Serapis was firmly lashed to the mizzen-mast of his ship. They lay side by side, so close together that the English gunners found it impossible to open their starboard ports, and were obliged to fire through and blow them off. So close were they that in loading the gunners of each ship had to thrust the handles of the rammers through the enemy's ports, in order to insert them into the muzzles of the guns.

The gunners of the Serapis had the best of it, however. In time every 12-pounder of the Bonhomme Richard but one was silenced, and only two 9-pounders were left in service on the fighting side of the deck. The strait was a desperate one. The ship was making water so fast that she threatened soon to sink, she was on fire in several places, and while in this perilous strait the Alliance sailed across her bows and, whether by mistake or through design on the part of her captain, poured in two broadsides, killing a number of her crew.

Yet Captain Jones continued to fight the enemy, the water, and the fire, though the water was five feet deep in the hold, and an officer, thinking all at an end, had released the two or three hundred English prisoners, the results of former captures, confined below. At this moment a frightened gunner sought to haul down the flag, crying to the British for quarter, but he was felled to the deck by an empty pistol flung at his head by the furious captain.

Meanwhile, Master's Mate Dale, a man of the captain's own type, shrewdly disposed of the released prisoners by telling them that the Serapis was sinking and putting them at working the pumps and fight-

NAVAL BATTLE BETWEEN THE BONHOMME RICHARD AND THE SERAPIS—1779.

ing the fire to save the vessel they were on. The end came through an act of one of the marines who were fighting the enemy from the maintop of the Bonhomme Richard. Climbing out on the yard-arm, he began dropping hand grenades into an open hatch of the Serapis below. The first of these chanced to fall into and explode a heap of gun-cartridges which had been carelessly piled behind the guns. The explosion was terrific in its effects, twenty of the British crew being fairly blown to pieces, others scorched or wounded, and the ship set on fire.

This ended the struggle. The fire of the marines from the tops and of the 9-pounders worked by Jones himself had cleared the upper deck of the Serapis, Captain Pearson being left there alone. As the roar of the explosion reached his ears and the smoke ascended through the hatches, his resolution at length gave way, and, running to the flag, which had been nailed to the mast, he tore it down with his own hands. Captain Jones, who, according to the ordinary rules of warfare, should have surrendered an hour before, now triumphantly gave the order to "cease firing." The Serapis was his.

A few words must tell what followed. The Bonhomme Richard was in such a state that it was impossible to save her, and at nine o'clock the next morning the gallant craft sank beneath the sea, her victorious battle-flag still flying at her mast. On board the Serapis Jones and his victorious crew came safely into port. Captain Pearson had made a brave defence, and the British ministry rewarded him for his courage by making him a knight. As for John Paul Jones, the furious officials denounced him as a pirate, putting

a price of ten thousand guineas on his head, dead or alive. In Paris, however, he was received as a hero, and his fame as a hero still exists. In regard to Captain Pearson's reward for being defeated, Jones satirically remarked that if he had a chance to fight with him again he would make him a lord.

Of the subsequent naval battles of the Revolution may be named that in which the Trumbull, half dismasted in a gale, was attacked by two British ships. Her crew were largely Englishmen, who ran below, leaving but fifty men to fight, among whom was Richard Dale, who had won fame on the Bonhomme Richard. For an hour the gallant fifty held their own against this double force, and surrendered only when a third British ship, the General Monk, came up and prepared to rake their decks at short range. In the same year (1781) the Alliance fought at once two British vessels, the sixteen-gun brig Atalanta and the fourteen-gun brig Trepassy, and captured them both. The last naval battle of the Revolution—except the capture of the General Monk by a privateer—was fought by the Alliance, Captain Barry. On March 7, 1782, she met the thirty-eight-gun ship Sibylle, and forced her, after nearly an hour's fight, to hang out signals of distress. But as two other British frigates were now near at hand, and as a French frigate on which Barry had depended for aid declined to take part, he was obliged to relinquish his prey. It will suffice to say, in conclusion, that, the difference in power considered, the record of the American navy in the Revolution was one of exceptional credit and honor.

CHAPTER II.

NAVAL WARS WITH FRANCE, ALGIERS, AND TRIPOLI.

The end of the Revolutionary War left the United States greatly destitute of naval vessels. Of those bought and built during the war, only three, bearing eighty-four guns in all, remained, the others having gradually disappeared before the far superior force of the enemy or through the perils of the sea. But they had nobly made their mark, and for the most part, like the Bonhomme Richard, came to their end with glory. American prowess on the sea had won acknowledgment throughout Europe, the achievements of the navy being added to by the deeds of the privateers, which had captured sixteen English cruisers, while not one American cruiser had been taken by a British privateer.

With the war the navy ended. All the men that remained were paid off and discharged and all the remaining ships were sold. Even Paul Jones, who had been highly honored by the Congress and people of the States, was permitted to pass from the service of America into that of Russia, and the new republic was left utterly undefended at sea. This lack of foresight in the government exposed our commerce freely to the ravages of the pirates of Algiers, then dominant in the Mediterranean and making all nations their prey. In a single cruise in 1785 the pirate squadron captured eleven American merchant ships and made

slaves of one hundred and twelve seamen. This outrage could not be avenged by our navy, there being not a single war-ship afloat under the American flag. Having no ships of its own, the government was obliged to build one for Algiers, which, armed and fitted for sea, and freighted with twenty-six barrels of silver dollars and many valuable presents, was sent to the Dey as a ransom for the captives in his hands.

This humiliation called attention strongly to the need of a navy, but years passed before Congress could be induced to pass a bill for its creation. The measure was finally carried by a majority of two votes only, and became law on March 27, 1794. As there was no navy, there was no naval department in the government, this not being organized until 1798, so that the carrying out of the new law fell into the hands of General Knox, Secretary of War. He conferred with Joshua Humphreys, a Philadelphia Quaker and at that time the ablest ship-builder in the United States, who suggested that, since this country could never support as many war-vessels as the great powers of Europe, its ships should be made as fast and strong as any craft afloat. He proposed a longer and broader vessel than the prevailing model and one sitting deeper in the water. It was to be capable of carrying as many guns on one deck as the others carried on two, and its greater stability would permit a larger spread of canvas, so that, if for any reason unable to fight, the Yankee ships could still outsail their opponents and escape capture.

The theories of Mr. Humphreys were accepted, and long continued to prevail in the American navy. Six frigates were ordered to be built on the new model,

—the Constitution, the President, and the United States, sister ships of forty-four guns each; and the Chesapeake, the Congress, and the Constellation, each of thirty-six guns. Of these, the United States, built by Humphreys, was first launched, on July 10, 1797. On October 21 of the same year the Constitution, famous later as the "Old Ironsides," touched the water. She is still afloat after a century of duty, a proud relic of the past. At a later date about a dozen smaller ships were built or bought, together with a number of brigs, schooners, and galleys, and by 1798 the United States, after a long interval of neglect, was once more provided with a navy.

It was ready none too soon. The Revolution had come in France, the new republic was at war with most of the powers of Europe, and its cruisers were freely capturing American merchantmen, without regard to whether they carried contraband of war or not, it being enough if they were bound to ports hostile to France. The condition was a strained one and resulted in a naval war between the United States and France. No declaration of war was made, but on May 28, 1798, the war-ships of the United States were authorized "to capture any French vessel found near the coast preying on American commerce."

At this time the American navy was made up of twenty-two ships, mounting four hundred and fifty-six guns and carrying three thousand four hundred and eighty-four men. These were not landsmen, as of old, but many of them had been trained in the cruisers and privateers of Revolutionary times, and others had spent their lives upon the sea. The first naval battle of importance in the new war took place on February

9, 1799, in the Caribbean Sea, between the Constellation, Captain Truxton, of old privateer fame, and the French thirty-eight-gun frigate L'Insurgente. The Frenchman held his own for an hour and a quarter and then surrendered. He had lost seventy in killed and wounded and the Constellation five. The two vessels were soon after separated by a gale, before all the prisoners had been removed, there being one hundred and seventy-three of the French crew still on board the L'Insurgente and but thirteen Americans. Yet the latter drove the prisoners below, and kept them there while for three days and two nights they were working the vessel into port.

On February 2, 1800, the Constellation had another severe battle with the enemy, this time with the Vengeance, a vessel in every way more than her match, her guns throwing eleven hundred and fifteen pounds of shot against eight hundred and twenty-six pounds for the Constellation. Yet Truxton fought his ship with such skill and valor that at midnight the Frenchman, unable to fight longer, lowered his flag. His main standing rigging had been completely shot away, and Truxton made vigorous efforts to save the mast, but before preventers could be sent up the spar fell, carrying with it Midshipman James Jarvis and several men. The brave young midshipman could have escaped before the mast gave way, but preferred to face death at his post. His devotion to duty has made him a hero in American naval annals.

The Vengeance was won and lost. She slipped away in the night and escaped, the Constellation being too crippled in her rigging to pursue. On October 12, 1800, another naval battle was fought, this time

between the Boston and the French ship Berceau. The Boston was the larger and stronger, but the valiant captain of the Berceau kept up the fight with indomitable courage, the battle continuing for twenty-two hours. At the end of that time the Berceau, reduced to a wreck, was obliged to yield.

This ocean war, fought without declaration, continued for nearly three years, ending with a treaty of peace signed February 3, 1801. The ships of war taken by our navy were returned to France; the privateers and armed merchantmen, seventy-six in all, were retained. No American war-ship was captured by the French except the fourteen-gun ship Retaliation, renamed from the Croyable, which had been taken from them in the beginning of the war, and was retaken by the thirty-eight-gun frigate L'Insurgente. The few conflicts of this war showed strongly the fighting power of the new ships of the American navy and the efficiency, courage, and discipline of their crews.

But our new navy was not left long at rest. The pirates of the Barbary states continued their raids upon American commerce, and on May 20, 1801, the Secretary of the Navy ordered a "squadron of observation" to the Mediterranean. Captain Richard Dale, the former master's mate of the Bonhomme Richard, was made commodore of this fleet, which consisted of the frigates President, Philadelphia, and Essex, and the twelve-gun schooner Enterprise, which had captured eight French vessels in the recent war.

The appearance of this fleet before Algiers soon brought the Dey to terms, and he grew warm in professions of friendship for the United States. But the

Bashaw of Tripoli continued hostile, and on August 1, 1801, a fight took place between the Enterprise and the Tripoli, of fourteen guns and eighty men. For two hours the battle continued, the corsairs twice lowering their flag and twice firing treacherously upon the Americans who came to take possession. At length, when the exasperated tars had determined to send them to the bottom, the captain of the corsair not only lowered his flag but flung it into the sea, and begged humbly for quarter. He had lost, in killed and wounded, nearly fifty of his eighty men, while the Enterprise had not lost a man.

The bashaw continued obdurate, and the blockade of his port went on. On October 31, 1803, the squadron met with a serious disaster, which in the end led to one of the most daring deeds in our naval history. The frigate Philadelphia, while in hot pursuit of a vessel that was running the blockade, pursued it too far for safety into the harbor of Tripoli, and suddenly ran upon a reef. Every effort was made to get her off, anchors and guns were thrown overboard, but all to no effect. The gunboats of the enemy came out and opened fire upon her; she heeled with the falling of the tide until she could bring no guns to bear upon her foes, and surrender became inevitable. The magazine was flooded, the pumps were disabled, holes were bored through her bottom, and, this done, the flag was hauled down and the officers and crew, three hundred and fifteen in all, surrendered themselves prisoners of war.

Two days later a strong wind raised the waters and the Tripolitans pulled the frigate off the reef, having first stopped up the holes in her hull. She was towed

in triumph to an anchorage near the bashaw's palace, her anchors, guns, and shot were recovered, and the Tripolitan shipwrights began to refit her as a welcome addition to their fleet.

This event was followed by the deed of daring of which we have spoken. In spite of the vigilance of the Moorish authorities, Captain Bainbridge, of the Philadelphia, managed to send a secret letter to the fleet, in which he suggested that an effort should be made to destroy the ship at her anchorage, and proposed the plan that was soon after adopted.

In command of the Enterprise at that time was Lieutenant Stephen Decatur, afterwards a famous captain and commodore in the navy. To him was intrusted the dangerous adventure suggested by Bainbridge. He had taken a Tripolitan ketch called the Mastico, and with this, and a picked crew and officers numbering about eighty in all, he sailed for the harbor of Tripoli, February 9, 1804. A gale hindered their entering the harbor until the night of the 16th, when, with all the crew hidden except six men in Moorish dresses, the ketch made its way towards the Philadelphia. The brig Siren, which accompanied them, remained outside to pick up the crew of the Mastico if they should be obliged to take to their small boats.

Professing to have lost their anchors during a gale, they asked and obtained permission to make fast to the cables of the frigate. They had but fairly done so, however, when some of the ship's crew perceived a number of men lying on the deck of the ketch, and, quick to take alarm, raised the warning cry of "Americano!" It was answered by the flinging of grapnels and Decatur's ringing cry of "Boarders away!" and

in an instant the deck of the Mastico swarmed with men and a rush was made for the frigate's decks.

The Tripolitans, taken utterly by surprise, made but a show of resistance, and in ten minutes those that survived were driven overboard and the frigate was an American prize, while a rocket shot high into the air to carry the tale of triumph to waiting friends outside.

No thought was entertained of getting the frigate off. That was impossible, and preparations had been made to burn her where she lay. Combustibles were rapidly spread and set on fire by eager hands. Midshipman Charles Morris, who had been the first to board the vessel, led the party that fired the cockpit, the lowest point that could be reached, but so rapidly did the flames shoot up on the decks above that he and his men had barely time to escape.

Into the ketch now leaped the boarders, Decatur the last to leave. The Mastico was in danger from the quick-leaping flames, but quick blows of an axe severed the ropes and she was got safely off, while the crew, running out the great oars, began to sweep their craft seaward as the flaring fire ran up the rigging of the Philadelphia to the mast-head and gleamed far and wide over the bay.

The Tripolitans, as soon as they had recovered from their consternation, ran to their guns, but their shot went wide, and the little vessel passed on unharmed. As the heat increased the guns of the frigate began to add their peals to those of the forts; at length the magazine was reached, the great hull burst open with a frightful roar, and the fragments of the Philadelphia were hurled far over the waters of the bay.

Of the Americans, not one lost his life. Escaping safely from the harbor, they reached their consort, the Siren, whose crew greeted them with welcoming cheers. And thus ended what Lord Nelson is said to have called "the most bold and daring act of the age." Decatur was made a captain and presented with a sword by Congress, and all that took part were rewarded for their share in the bold exploit.

The remainder of the year 1804 was marked by various efforts to take the city of Tripoli, a fierce fight between gunboats taking place on August 3, while soon afterwards a disastrous event occurred. The ketch Mastico, or the Intrepid, as she had been renamed, was prepared as a fire-ship and sent into port with the hope of causing ravage among its shipping. The attempt was made on the night of September 4, but from some unfortunate cause the ketch blew up with all on board, not a soul of them escaping. In the end the bashaw, alarmed by an insurrection in his own dominions, consented to yield all his prisoners for a ransom of sixty thousand dollars and nevermore to trouble American commerce. The terms were accepted and peace ensued. Tunis was next brought to terms under the guns of the American fleet, and for the time all trouble with the Barbary states was at an end.

At a later date trouble with them recommenced. Algiers took advantage of the war with Great Britain to renew its depredations on the commerce of the United States, and in May, 1815, Decatur reached the Mediterranean with a squadron sent to bring the Algerians to terms. He captured two of their war-vessels, and in June the Dey of Algiers was glad to

sign a treaty of peace, in which he agreed to release all captives, make indemnity for past captures, give up forever all claim on the United States for tribute or presents, and in the future not to make slaves of prisoners of war. Decatur next visited Tunis and Tripoli and forced from them an agreement to observe their former treaties. This ended the piratical career of the Barbary states, which had existed for centuries, and which the United States were more instrumental than any other nation in bringing to a close.

CHAPTER III.

THE SECOND WAR WITH GREAT BRITAIN.

The depredations on American commerce, which had given rise to the naval war with France, did not cease with its close. Napoleon was then pursuing his remarkable career of victory, Great Britain was opposing him with bitter energy, and the commerce of neutral nations suffered wherever they ventured to oppose the will of these two great combatants. Ships bound to ports under the control of one were liable to seizure by the war-vessels of the other, and America lost so heavily on both sides that it became a question with which country she should finally declare war. Napoleon had treated American merchants with the basest perfidy and robbed them mercilessly. But he confined his attacks to the wealth of this country, while his opponent attacked its honor as well. It was the

doctrine of the "right of search" that finally brought America and Great Britain into war.

In the attempt to impress seamen claimed to be of British birth from American ships, decision in which was left to the arbitrary power of naval officers, thousands of American citizens were taken and forced to serve in British war-vessels. The arrogance of the British in this system of seizure reached its climax in 1807, when an American war-ship, the Chesapeake, while wholly unprepared for action, was fired into by a British frigate, the Leopard, and forced to submit to being boarded by a press-gang and robbed of several of her crew, among them three of American birth. In 1811 another example of arrogance was given, this time with a different termination. The British corvette Little Belt, being hailed from the deck of the frigate President, replied by a cannon shot, the ball striking the mainmast of the President. A shot in return called out a broadside from the Briton. And now for some fifteen minutes the President poured iron arguments into the insolent corvette, quite curing her of her eagerness to fight. It was the first blow against the rapacity of the press-gang. Another was dealt when the Constitution, lying in a British port, gave refuge to a deserter who claimed American birth, showed her teeth to two frigates who sought to take him from her deck, and sailed off with him in triumph.

The natural result of this strained condition of affairs came on June 18, 1812, when war with Great Britain was declared by the Congress of the United States. The conflict that followed was remarkable in one particular,—that of showing the unlooked-for fighting power of American ships and American

sailors when matched against the boasted rulers of the wave. It is with the naval exploits of this war that we are here concerned.

There was little room for confidence in American naval power at that date. Numerous gunboats for harbor defence had been hastily prepared, but this country possessed only fifteen war-vessels fit for service at sea, mounted with about four hundred guns. Against these Great Britain could show one thousand and forty-eight ships with twenty-seven thousand eight hundred guns, and of these ships more than one hundred were soon on our coast, twelve of them being seventy-four-gun ships of the line. It was not in the number of her ships alone that our antagonist placed confidence, but in their record as well. They had long been paramount upon the seas of Europe. They had destroyed the navy of Denmark at Copenhagen. Under Nelson they had won undying glory at Aboukir and Trafalgar Bay. The navies of France and Spain had proved helpless before them. The Dutch and the Russians alike feared to try conclusions with them. They were the acknowledged lords of the sea, and crossed the ocean with the full expectation of teaching the Americans a lesson to be long remembered. To their utter consternation, the lesson took the opposite form. Brave as the British captains and crews undoubtedly were, over-confidence had made them careless in discipline and the arts of seamanship, and they were destined to lose their proud pre-eminence upon the seas.

The success of the Americans was due to the superior character of their ships, the higher discipline of their crews, and the better service of their guns.

Their cannon were heavier, and every shot told. While the British gunners fired largely at random, the American guns were sighted and every ball went straight to its mark. And the men were trained in a manner far superior to that of the British seamen of that day. As a consequence, only two or three American ships of war were captured, by antagonists of equal strength, throughout the war, while many of the best British war-ships were sent triumphantly into port or despatched to the bottom of the seas.

The first event which we need record in this war was the capture of the corvette Alert by the American frigate Essex, Captain Porter. This fight lasted but eight minutes. The Alert was much the weaker of the two, and our only purpose in mentioning it is to record the fact that David G. Farragut, the naval hero of the Civil War, was a midshipman on the Essex, and that it is to his journal we are indebted for our account of the affair. He was then a boy of less than twelve years of age.

It is to the Constitution, however, that we owe the first great triumph of the American fleet. This ship, under Captain Isaac Hull, began her career in the war by a famous escape from a British squadron on the Jersey coast. Pursued by five frigates, the wind most of the time so light that progress was to be made only by towing, for three days, from July 17 to 20, the Yankee ship managed to keep just out of gunshot of her eager pursuers, until finally she succeeded in dropping them below the horizon and the squadron gave up the pursuit in despair.

A month afterwards, on August 19, the Constitution met one of her late pursuers, the Guerrière, and

now, with but a single antagonist to deal with, the Constitution played a different *rôle.* The two ships were well matched in strength and the crews in courage, yet in thirty minutes from the time the Constitution fired her first broadside the Guerrière lay a helpless wreck on the waters and her flag was down. All her masts were gone, her hull was like a sieve, and more than a fourth of her crew were dead or wounded, while the Constitution was little the worse for the fight and had lost but fourteen men. The difference was due to the far superior gunnery of the American crew. The Guerrière was past being taken into port and was set on fire, the explosion of her magazine as she sank heralding the end of British supremacy upon the sea.

The news of this battle had an amazing effect. The admiralty of Great Britain was utterly confounded at the result, while all Europe was startled to learn that in so short a time an American ship had utterly demolished, almost without harm to herself, one of the boasted rulers of the wave. It was one of the most striking events in all naval history, and the people beyond the Atlantic awoke to the fact that they had a new power to deal with in the young republic of the western world. As for the people of America, they simply went wild with joy.

The lesson thus taught was soon reinforced with others of the same kind. On October 18 the sloop of war Wasp, Captain Jones, met the British brig Frolic in a high wind off Cape Hatteras. Despite the fact that the ships were rolling and pitching in a heavy sea, a battle began. Most of the British shot went high, carrying away the upper spars of the Wasp;

FRIGATE CONSTELLATION—LAUNCHED 1797.

but her guns, carefully sighted and fired at the right moment, played havoc with the Frolic's hull. At length the two ships came together with a crash and boarders from the Wasp sprang upon the Frolic's deck. Only four men were in sight, three of them wounded, while water reddened with blood swashed about the deck. The leader of the boarding party himself hauled down the flag. America gained nothing materially from this victory, for the little Wasp and her prize were soon after taken by a British seventy-four, the Poictiers. But the moral gain was immense, and the British alarm and amazement at American prowess grew greater than before.

The next triumph took place on October 25, 1812, when the frigate United States, under Captain Stephen Decatur, while cruising between the Azores and the Canaries, met the British frigate Macedonian. It will suffice to say of this conflict that after an hour's fight the Macedonian was a helpless wreck, while the United States showed little injury from the battle. She had lost but eleven men in killed and wounded, while the Macedonian had lost more than a hundred of her crew. The result, as before, appears to have been due to the comparative skill in gunnery, the hull of the British ship being pierced by more than one hundred shots, while the American ship received but three in return.

On December 29 the Constitution, now under Commodore Bainbridge, won a second victory, this time over the British frigate Java, off the coast of Brazil. At two o'clock the firing began, the British gunners firing wild, the Americans with careful aim. At four o'clock the Java had lost nearly all her masts, while the

Constitution had every spar in place. As for the hull of the Java, it was so riddled as to make it impossible to bring her into port, and she was set on fire on the closing day of 1812. In six months the American frigates had taken five British men-of-war, while not a ship had been lost from the small navy of the republic. Not in twenty years of its history had the British navy suffered such a series of defeats as in these momentous six months.

A sixth American victory came on February 24, 1813, when the sloop of war Hornet encountered the brig Peacock off the mouth of the Demerara River, South America. The vessels were not unfairly matched in size and armament, yet so swift and sure was the Yankee fire that in fourteen minutes the Peacock's flag came down, her hull being so riddled that before all the crew could be taken off she sank.

And now came a reverse to this tale of triumph. Captain Lawrence of the Hornet was rewarded for his victory by being transferred to the frigate Chesapeake, which on June 1, with a newly shipped and undisciplined crew, sailed from Boston to try conclusions with the British frigate Shannon, then hovering outside. The battle was a brief one. Captain Broke of the Shannon had profited by the story of American warfare, and had trained his men carefully at the guns. The crew of the Chesapeake were without training and experience. And shortly after the first broadside Captain Lawrence was mortally wounded, and was carried below, saying, "Tell the men to fire faster, and *not give up the ship.*"

In ten minutes after the battle opened the two ships drifted together, and Captain Broke, followed by a

boarding party, sprang upon the Chesapeake's deck. A sharp but brief fight followed, and in fifteen minutes from the beginning of the conflict the Chesapeake was a British prize. She was taken into Halifax, Captain Lawrence, in a delirium, constantly repeating his last order, "Don't give up the ship." He died before Halifax was reached. This ended the most serious reverse of the American navy during the war, a result hailed in England with as extravagant a joy as if a victory by a British ship was an unheard-of event.

There was one more victory of the British arms in 1813 that may be here recorded. It was won over the little sixteen-gun ship Argus, Captain Allen, which had sailed from New York to France, and on July 14 left L'Orient for a cruise in the English Channel, in emulation of the career of the famous Paul Jones. The seas here swarmed with merchantmen, and prizes were taken in numbers, some of these being sunk and some burned, while a few of the more valuable were sent to French ports. In a month's time twenty ships, valued at $2,500,000, fell victims to the Argus. Her fate came on August 14, when the British brig Pelican sought and found her off the harbor of Cork. The captain of the Argus was mortally wounded by the first broadside; his lieutenant met the same fate four minutes afterwards, and the ship, unmanageable from injuries to her rigging, was scarcely able to reply with a gun to the broadsides of her opponent. The flag was therefore hauled down and the British gained their second prize.

Of all American vessels of war, the one with the most unceasing run of good fortune was the Enterprise. Launched in 1800 and rigged as a schooner,

she had been sent to the West Indies to search for French privateers, of which she soon captured eight, one of them, L'Agile, a larger and better-armed vessel than herself, after a sharply contested battle. A year later she captured the Tripoli and the Mastico in the Mediterranean war, as already described. In 1812 her rig was changed, she being converted into a brig, and losing speed in consequence. She was sent out in search of privateers, in which she had much success, and on September 4, 1813, when near Portland, Maine, came in sight of a brig that bore every appearance of being a man-of-war.

Lieutenant Burrows stood off shore to get sea-room, at the same time cutting one of his stern windows into a port that would take one of his long guns, much to the dissatisfaction of his crew, who thought he proposed to run away. They did not know their commander, who had been but three days on board. The offing gained, he wore and ran for his enemy, both ships firing broadsides at the same time. The battle began at three P.M. At 3.45 a British officer shouted that they had surrendered, but could not haul down their flags as all of them were nailed to the masts. Both commanders were killed, and the Boxer, which proved to be the name of the British ship, had suffered severely in the fight. The Enterprise was little the worse for the enemy's guns, though the ships had been very evenly matched.

In her subsequent history the good fortune of the Enterprise continued. Slow as she was, she made several successful runs from British frigates, and came through the war unharmed. She was sent to the Mediterranean during the war with Algiers, took part

in the war with the West India pirates, and perished at last of sheer old age, without having known a reverse.

There is but one more naval event of 1813 of which we need speak, that of the battle of Lake Erie, the first conflict of two fleets in American history with the exception of that between Arnold and Carleton on Lake Champlain in the Revolutionary War. In the first year of the war the British commanded the great lakes, and were enabled by the aid of their ships to hold Detroit and control the northwest. In the spring of 1813 Captain Oliver H. Perry was sent to contend for the mastery of these waters. Some progress had been made in ship-building at Erie, and in a remarkably brief time he had built two new vessels, converting forest trees rapidly into ships. With great difficulty he obtained men and arms for these and some others he had found on the lake, and in August sailed with his small fleet in search of the enemy. But the British were refitting, and it was not until September 10 that the two fleets met, there floating at the masthead of Perry's flag-ship, the Lawrence, a flag with the famous words of the brave Captain Lawrence, "Don't give up the ship!"

The fleets were fairly well matched in strength, and were fought with equal courage and resolution, both sides suffering severely. The Lawrence, which kept in the thick of the fight, was in time converted into a wreck, with but fourteen men unhurt on her decks. Meanwhile, the Niagara, which had for some unknown reason kept out of the battle during these two hours' fight, now came up fresh and unhurt. Perry at once, with the quickness of genius, sprang into a boat and

had himself rowed through a hot British fire to this welcome ship. Hoisting his flag on her, he sailed through the British fleet, firing broadsides right and left into their battered ships. In fifteen minutes more the victory was his, and he was able to send out his famous despatch, "We have met the enemy and they are ours."

Two victories of British arms have been mentioned. A third remains to be told, though it was one in which an American ship succumbed to superior force. The Essex, the smallest of the American frigates, whose capture of the Alert has been spoken of, sought the Pacific in 1813, where many captures of British whalers and other vessels were made. Captain David Porter, the father of Admiral Porter of the Civil War, was in command, and among her officers was, as we have said, the youthful midshipman David G. Farragut. The exploits of the Essex during her year's cruise in the Pacific may be passed over and our narrative be confined to the story of the end of her career.

Early in 1814 she had sought the harbor of Valparaiso, and here on March 28 she was attacked by two British ships, the frigate Phœbe, alone outmatching the Essex, and the Cherub, mounting thirty guns. And the British had a further advantage, in the Essex having lost her maintop-mast and in the battle being fought at long range, which the superior sailing-power of the British enabled them to keep. The main battery of the Essex was of short thirty-twos, of small range, and she had but six guns of long carrying power as opposed to seventeen on the gun-decks of her foes. The result was that most of her battery was useless, while every shot of her antagonists told.

Yet with these disadvantages she made a gallant fight, continuing it for two hours and a half, at the end of which time she was reduced to a floating wreck, nearly three-fourths of her crew were killed or wounded, and she was in flames below. Never had a flag been lowered after a more gallant struggle for victory.

We have now some further triumphs of American ships to recount. On April 28, 1814, the corvette Peacock, a newly built vessel, under Captain Warrington, met the British brig Epervier off the Florida coast. The vessels were fairly well matched and the fight was sharp, but the Epervier was so severely punished that in forty-five minutes she lowered her flag, her rigging being shot away and her hull so riddled that there were five feet of water in her hold.

In May, 1814, the Wasp, Captain Johnston Blakeley, a new sloop of war, the third vessel of that name in the American navy, crossed the ocean to the waters of Great Britain. Here, on June 28, she encountered the British brig-sloop Reindeer, which was forced to strike her colors after a half-hour's fight, the captain being dead and the vessel in such a condition that she could not be carried into port, and was fired and blown up the next day.

On September 1 the Wasp came within sight of a convoy of merchantmen guarded by a British seventy-four, yet she managed to cut out and burn one of the ships and escape pursuit. The same day she sighted four vessels, three of them of the same class as the Reindeer, and the fourth a merchantman which they had recaptured from an American privateer. As these were somewhat widely separated, one of them being in chase of the privateer, the Wasp dashed for the

nearest, and in about an hour had forced her to lower her flag. She did not take possession of her prize, however, as two other British ships were fast coming up. But she had done her work so thoroughly that the Avon went to the bottom just as her consorts had taken off the last of her crew. That was the final triumph of the Wasp. She went down herself in a storm at sea before the end of the year.

The history of the war records another lake conflict, a battle of squadrons on Lake Champlain, with as fortunate a result for the Americans as that on Lake Erie. Its result was of the highest importance, since it put an end to a purpose of invading the States by way of Lakes Champlain and George, having thus the same effect as Arnold's defeat. The British proposed to send a fleet of considerable strength to accompany the land forces, and Lieutenant Thomas Macdonough, naval commander on the American side, gathered a fleet in defence, one of these, the brig Surprise (later named the Eagle), being built in the brief interval of nineteen days. The fleet comprised fourteen vessels in all, of which ten were gunboats. Their crews numbered eight hundred and eighty-two men, and their armament eighty-six guns. The British fleet was not greatly different in strength.

The battle, which took place September 11, 1814, was not one of manœuvres in open water, like that of Lake Erie. Macdonough's vessels were anchored in Plattsburg Bay, in a position that hindered the British fleet from passing down the lake without fighting its way, and so arranged that they could wear round and use both broadsides in the battle. We have not space to describe the varied evolutions of the

conflict, and must content ourselves with saying that after a vigorously contested fight one British flag after another came down, until the whole fleet with the exception of the gunboats, which escaped by flight, was in American hands.

The victory ended the ambitious scheme of invasion. The British army had been stationed where the battle of the ships was in full view, and at its end Sir George Prevost, the commander, fled in a panic, leading his army back in all haste to Canada and abandoning immense stores. He is said to have died afterwards from chagrin at this exhibition of cowardice. His army had embraced twelve thousand of Wellington's veteran soldiers.

A treaty of peace was signed at Ghent, December 24, 1814. But those were not the days of ocean cables and land telegraphs, and news of this event spread so slowly that the war drifted on into 1815, one land battle, that of New Orleans, and several naval battles being fought in the early months of that year.

The first of these sea-fights had to do with the frigate President, then commanded by Stephen Decatur, and whose history had been one of continued ill-fortune. On January 14, 1815, she left New York for a cruise, and in crossing the bar at Sandy Hook struck the sand and lay pounding there until she had fairly "broken her back." Warped out of her fair shape, she put to sea, where she kept her reputation for ill luck by sailing into the midst of the British blockading squadron, which Decatur had hoped to elude. This consisted of four frigates.

Decatur tried to find safety in flight, but finding himself outsailed he turned on the Endymion, hoping

to take her by boarding. The wary Briton, however, kept away, and a sharp battle ensued in which the Endymion was fairly whipped, her fire being entirely stopped. But the President was also seriously crippled, and her renewed effort to escape was checked by the other frigates, to which, after a broadside from the Pomone, she was forced to haul down her flag.

A different story comes from the Constitution, the "Old Ironsides," so called before it was conjectured that the term "Ironsides" would in time come to apply to war-ships in general. On February 20, 1815, when about one hundred and eighty miles from Madeira, she sighted two sails, which proved to be the small British frigate Cyane and the ship-rigged sloop of war Levant. Captain Charles Stewart was in command of the Constitution, and at once gave chase, soon coming up with the foe. The three ships now prepared for battle, and for several hours the seas reverberated with the roar of guns. The Constitution opened fire at 6.10 P.M., and at 6.50 the Cyane lowered her flag. The Levant, which had sailed away from too hot a fire, was now followed and brought to bay, and at 8.50 she also became a prize. The "Old Ironsides," which had begun the war with the capture of the Guerrière, ended it with this signal triumph over two antagonists.

There is an escape of the Constitution with her prizes still to be recorded. On March 10, as they lay in the harbor of Porto Praya, Cape Verde, three large British frigates were seen coming in. Either of them was more than a match for the Constitution, and Stewart at once put out from port, manœuvring so skilfully that he carried his ship and the Cyane out of

reach. The Levant was driven back into port and recaptured, after her pursuers had fired a number of broadsides at her without a shot touching her hull.

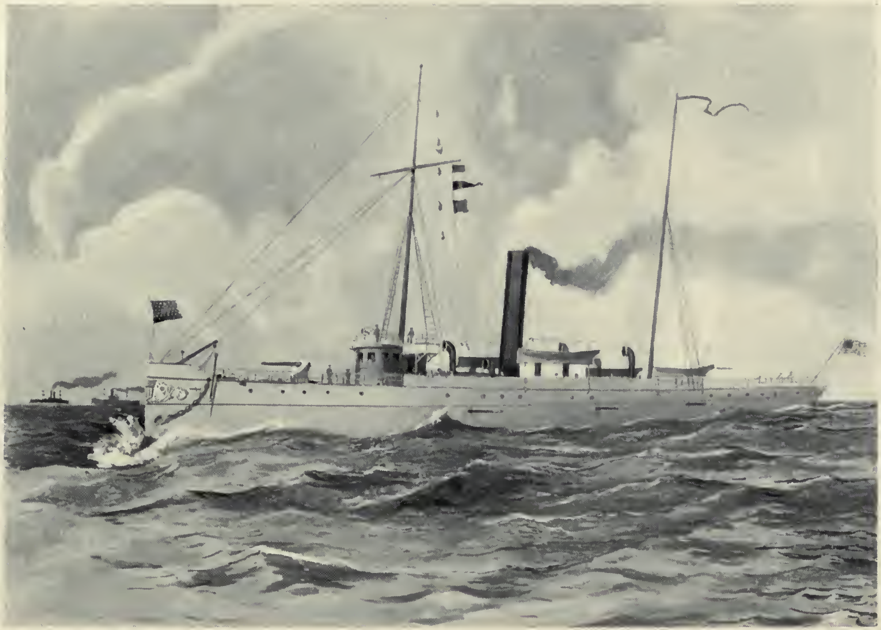
We have said that the Constitution ended the war. This is not quite the case, since a sea fight on a smaller scale took place as late as March 23, at the far Southern island group of Tristan d'Acunha, where lay the little sloop of war Hornet. The British brig-sloop Penguin had been sent there in search of a privateer, but found the Hornet instead, and, after a fight of twenty minutes in length, surrendered. It was time, for she was reduced to a wreck.

Nothing has been said here of the doings of privateers in this war, yet much might be said, for they were numerous and by no means confined their attention to unarmed merchantmen. The perils of seizure to which American merchant vessels were exposed before the war, with the gains to be made from successful voyages in consequence of the high rates of freight prevailing, had given rise to a class of vessels specially built to escape pursuit. Long, narrow, and deep-keeled, with enormous spars that carried a great cloud of canvas, they had become marvels of speed, and swift indeed must be the cruiser that could run one of them down in a fair chase. They were built to carry large crews, and little change was needed to convert them into efficient privateers, other than to add to the guns that most of them carried as security from the West India pirates, and to mount the famous "Long Tom" of the period, a long, thick-breeched gun that could throw a ball of twenty-four or thirty-two pounds' weight for a mile or more of distance. The pilot-boats also, built as racers and to

stand all weather, were easily converted into privateers, and the Atlantic soon swarmed with these alert commerce destroyers, of which some two hundred and fifty were commissioned during the war. One of their most famous captains was Joshua Barney, who had been made a lieutenant in the American navy in 1776, at seventeen years of age, and who commanded the cruiser Hyder Ali when she overcame the much stronger General Monk.

The most famous exploit of a privateer took place in the harbor of Fayal, Azore Islands, on the night of September 26, 1814. Here lay the General Armstrong, hailing from New York, and here, despite the fact that it was a neutral port, she was attacked by the boats of the British brig Carnation, the frigate Rota, and the liner Plantagenet, the three having caught her in harbor. All night long the fight continued, much of it hand to hand, but the eighty-eight tars of the Armstrong succeeded in fighting off their more than three hundred assailants, killing and wounding far more than the total number of their own crew, while their loss was very small. In the morning, finding that the British had begun to fire broadsides, they scuttled and abandoned their vessel, and she was set on fire by her captors and destroyed.

A similar fight had been made by the New York privateer Prince de Neufchâtel, which was attacked off Nantucket, October 11, 1814, by the boats of the frigate Endymion. The Prince had manned so many prizes that only forty of her crew remained, but these fought off their assailants, sinking one large boat and capturing another, while the British loss in killed and



COMPOSITE GUNBOAT MARIETTA.

wounded was not less than ninety. The Prince came safely into port.

The Baltimore privateer Chasseur attacked the British war-schooner St. Lawrence, mistaking her for a merchantman. But the discovery of his mistake and of the greater strength of his opponent did not check the fighting spirit of Captain Boyle, and in fifteen minutes from the beginning of the attack the St. Lawrence was a prize.

During the war the American privateers are said to have taken and sent in or destroyed about sixteen hundred British vessels, of which a considerable number were small war-ships. In return the captures by the British numbered but about five hundred. In this war, in which the army record was in great measure unfortunate, the navy covered itself with glory, and taught the powers of Europe that the sons of the Western republic had no superiors upon the seas.

CHAPTER IV.

THE PIRATES AND THE MEXICAN WAR.

About the beginning of the nineteenth century piracy became active in the West Indies, inspired by the long wars between Great Britain and France, during which the latter government issued letters of marque freely to lawless men, many of them wretches utterly unfit to be intrusted with such authority, and who entered upon careers of open piracy, making the

commerce of all nations except France their prey, and availing themselves of the French islands of Guadeloupe and Martinique as lurking-places. The British vigorously attacked these pirate broods, and finally, by the capture of Guadeloupe, in 1810, deprived them of their last place of shelter in that region.

From the West Indies they sought the Gulf coast of the United States, many of them becoming smugglers, while others kept to their old calling, finding new haunts in the bays and bayous of the Louisiana coast region. Here exists a broad extent of low, flat lands, traversed by countless water-courses, with stretches of tall marsh grass intervening, and deeply indented with bays, whose mouths are closed by long, narrow islands. The whole region is a net-work of lazy bayous, twisting and winding interminably, their multitude of islands being covered with bulrushes and reeds twelve feet high.

Of the many bays of the coast, the pirates chose the one known as Barataria for their lurking-place, and for several years they haunted the waters of the Gulf, making all commerce insecure. The difficulty was added to by the condition of the Spanish colonies, several of which were in revolt against the mother country. Of these, Venezuela issued letters of marque, and many of the pirates posed as patriotic privateers of the new government. The notorious Lafittes of New Orleans became in time the leaders of the pirate horde, they and their followers gaining impunity when the war with Great Britain tied the hands of the American authorities.

Several efforts were made to break them up, but in vain, and success was not attained until 1814. On

September 16 of that year Commander Patterson, of the navy, attacked their haunt with a small fleet of six gunboats and a schooner convoying six barges of troops. Within the bay ten pirate vessels were drawn up to receive them. But the corsairs made a weak defence, and were quickly driven ashore from their vessels, two of which were burned and the others captured. Most of the pirates were taken and their haunt was effectually broken up.

Among those who escaped were the two Lafittes, and these afterwards offered their aid and that of their followers to General Jackson, and fought bravely in the defence of New Orleans. Jean Lafitte in the end made his way to Texas, where he resumed his piratical practices, and as late as 1822 his name was the terror of the Gulf. Soon after the United States fleet swept those waters and brought the career of the buccaneers to an end. What became of Lafitte remains unknown.

For years after the close of the war with Great Britain the West Indies swarmed with pirates, whose crews may have been added to from the privateersmen of the United States. To many of the baser sort of these men robbery on the high seas had become a trade, which they were loath to abandon at the cessation of the war. The plundering of non-combatants under process of law was followed by plundering in defiance of law, and many swift-sailing vessels haunted the waters of the West Indies and the Gulf, ready to take a rich prize wherever found. Those seas long continued unsafe to honest merchantmen. Of the craft of commerce that put to sea with valuable cargoes, numbers were never heard of again, while many others had thrilling tales to tell of hot pursuit

by and narrow escape from armed vessels flying the black flag of piracy.

It was in the year 1819 that the government of this country undertook the task of destroying the nests of the corsairs in the West India waters. The command of the fleet detailed for this purpose was assigned to Commodore Perry, the hero of Lake Erie. It proved an unfortunate service for him, for, while calling at Angostura, then the capital of Venezuela, on a mission to learn the names of the privateers commissioned by that republic, he was seized with yellow fever, from which he soon died. With his death the work of the expedition came to an end and nothing further was attempted until 1821.

In that year a new fleet was sent out, comprising the sloop of war Hornet and the brig Enterprise, both famous for their exploits in the late war, and some smaller vessels. Several of the piratical craft were captured, and in 1822 the fleet was largely increased, Commodore James Biddle of the Macedonian taking command. Much progress was now made in the work of breaking up the piratical horde, the Shark, under Captain Matthew C. Perry, afterwards famous for the opening of Japan, capturing five pirate vessels and aiding in the capture of a sixth.

In 1823 Captain David Porter, formerly commander of the Essex, was placed in control of the fleet, to which he added a number of small schooners and barges, fitted to follow the corsairs into their haunts. With him came his former midshipman, Farragut,—not yet in command of a vessel. Much was now done in the work of breaking up the pirate resorts. At Cape Cruz the crews of the Greyhound and Beagle

captured one of these resorts after a desperate resistance, in which the wife of the pirate captain fought by his side and as fiercely as himself. In the caves were found bales of merchandise and heaps of human bones that told a terrible story of robbery and murder. In another instance two barges of the fleet, carrying thirty-one men, chased a pirate cruiser and barge into a bay, and dashed among the sea-robbers, over seventy in number, with such intrepidity, that they were driven into the sea and the most of them killed while attempting to swim to land. Among the killed was their captain, known as Diabolito ("little devil").

Porter was subsequently suspended from command, in consequence of a dispute with the Porto Rico authorities, and resigned his commission. But he had practically completed his work, which was finished in the following year. Since 1824 the black flag of piracy has not been seen in the waters of the West Indies and the Gulf.

The dealings of the United States with the Barbary pirates were described in the last chapter. At later dates there were encounters with pirates elsewhere, beginning with an assault by the Malays of Sumatra on the ship Friendship in 1831. This was revenged in 1832 by the frigate Potomac, which anchored off Quallah Battoo disguised as a merchantman, and at midnight made an attack on the Malay forts. The resistance was fierce, even the women fighting with courage and skill, but in the end the natives were overpowered and their chief fort was blown up with its own magazine. In 1838 the town of Quallah Battoo was again bombarded by the frigate Columbia, in conse-

quence of a murderous attack made by the natives on the crew of the ship Eclipse.

In 1849 a United States vessel was sent to the coast of Africa to aid in breaking up piracy of a different kind,—that of the slavers who had long plied their nefarious trade in those waters. This was the brig Perry, under Lieutenant (afterwards Admiral) Andrew H. Foote. The British were active in trying to break up this traffic, and for two years the Perry was kept busy at the work, capturing several American vessels engaged in the trade.

In 1856 the same officer, now captain of the Portsmouth, became engaged in more warlike work in China. Fighting was going on between the English and Chinese, and Foote was there for the purpose of protecting the Americans in Canton. On November 15, while he was rowing past one of the forts of the city, the Chinese fired upon him, despite the fact that the American flag was waved. On passing a second fort, it opened on him with grape-shot at close range. On the next day the Portsmouth bombarded the forts, and on the 20th the Portsmouth, the San Jacinto, and the Levant resumed the bombardment, and landed a force that attacked the forts by land.

The first fort, a massive stone structure containing numerous cannon, was quickly taken, and its guns were turned on the second, whose fire was soon silenced. A strong force that marched from Canton was put to flight by a single howitzer, and the contest did not end until four of the forts had been taken. After this lesson the Americans were not molested.

In 1859, however, Captain Josiah Tatnall made himself famous by the part he took in the war between

China, England, and France. While some English gunboats were removing obstructions from the Peiho River, a fierce fire was opened on them by the Chinese forts. Tatnall, stirred by the spirit of Anglo-Saxon kinship, ordered his boat to be manned, saying to one of his officers, "Blood is thicker than water." Rowing to the British gunboat, he took efficient part in its fight with the Chinese. This act, while against international law, has gone far to strengthen the feeling of brotherhood between the American and English peoples.

The outbreak of war with Mexico, in 1846, was followed by active movements in the navy. It was preceded, indeed, by naval movements, for in 1842 a squadron, comprising the old frigate United States, the captured sloop Cyane, the sloop of war Dale, and the schooner Shark, under Commodore Thomas ap Catesby Jones, was sent round the Horn to guard American interests on the Pacific coast and prevent England from grasping the loosely held Mexican province of California. On reaching Callao, Commodore Jones read a despatch in a newspaper of that port stating that Mexico had just ceded California to Great Britain, and that very evening the British frigate Dublin appeared off the harbor. On seeing the Yankee squadron inside, the Briton turned and sailed away again without casting anchor. Jones, connecting this curious movement with the newspaper statement, immediately hoisted anchor and sailed away in all haste for California, reaching the harbor of Monterey on October 19. There were no signs of the Dublin, but he landed and took possession. He learned the next day that Monterey still belonged to

Mexico, which was at peace with the United States, so he gave the town up again with what apologies he could muster. Jones was recalled for this action, but in no way punished. The administration was in full sympathy with his act.

When news of the declaration of war reached the Pacific slope, Captain John D. Sloat, then commodore of the squadron, at once sailed for Monterey in the frigate Savannah. He found several other United States vessels in the harbor, and hastened to seize the town. A week afterwards the Portsmouth took possession of San Francisco Bay.

Sloat was in bad health, and soon afterwards transferred the command to Captain Robert F. Stockton, who took possession of the port of Los Angeles, where he organized a State government, placing John C. Fremont at its head. Various other minor operations took place along the coast, the ships co-operating with the land forces, the war in that quarter ending with the Americans in full possession of California.

Meanwhile, the navy in the Gulf was operating against the Mexican coast, its first work being at the mouth of the Rio Grande, to help protect the garrison which General Taylor had left at Point Isabel. Commodore David Conner was in command, but was poorly provided with ships, with which he made two unsuccessful attempts to take Alvarado, an important port south of Vera Cruz.

The principal achievements of the navy before the siege of Vera Cruz were the capture of the important port of Frontera and of the city of Tabasco, which lay some distance up the river at whose mouth Frontera is situated. This work, performed by Captain Perry,

gave the Americans control of the adjoining province of Yucatan until the end of the war.

The chief work demanded of the fleet, however, was the capture of Vera Cruz, which General Scott proposed to make the starting-point of his march upon the capital of Mexico. In March, 1847, a fleet of seventy ships and transports was gathered before this port, conveying the twelve thousand six hundred men of Scott's army of invasion.

It was decided to make the attack by a combined land and naval force, and land batteries were planted which began the bombardment on March 22, 1847. The next day an attack on the castle of San Juan de Ulloa was begun by the fleet.

Commodore Conner, who had made all the dispositions for the bombardment, was unfortunate in not being able to take part in the triumph. His term of service with that fleet expired, under the regulations of the Navy Department, on the 21st, and he was succeeded by Commodore Matthew C. Perry, who carried forward vigorously the work he had begun. On March 25 the bombardment of Vera Cruz ceased, at the request of the Mexicans. Three days afterwards the city was surrendered. The navy had completed its service for that war.

Not many years afterwards Commodore Perry performed an important work not only for the United States, but for the civilized world, in the opening of Japan to commerce and friendly intercourse. For several centuries the island empire of Japan, incensed at the behavior of its first Christian visitors, had closed its ports to the world, and remained persistently isolated. After the beginning of the nineteenth century

several efforts were made by European nations, and particularly by Russia, to put an end to this policy of isolation, but in vain. The United States joined in these efforts. Commodore Biddle was sent to Japan with two frigates in 1845, but failed to overcome the distrust of the islanders. Commodore Perry succeeded to this mission in 1852, and reached Japan in the following year with the steamers Mississippi and Susquehanna and the sailing ships Saratoga and Plymouth. On July 8 he entered the Bay of Yedo, disregarding the Japanese injunction that all foreign ships must confine their visits to the port of Nagasaki.

An earnest effort was made by the Japanese to induce him to leave the bay, but this he positively declined to do, and insisted on their taking to the emperor the letter he bore from the President of the United States. The size and threatening character of his ships added to the force of his words, and after some fruitless denials the Japanese officials at length agreed to his demand. Leaving the letter, which was ceremoniously received, Perry sailed away, saying that he would return after some months for an answer. He reappeared in February, 1854, with a larger fleet than before, and now, by unyielding persistence, succeeded in obtaining a treaty of commerce and friendship with Japan in which all his demands were conceded.

The wall of Japanese isolation thus broken down, all attempts at seclusion were soon given up, treaties being made with other nations, and an active commerce established. The work of Commodore Perry has proved of more advantage to Japan than to any other nation, since that country has emerged from the

position of an empire absolutely without influence in the councils of the nations into that of one of the leading powers of the world.

There is one other event which should be related here, that known as the Koszta incident. Martin Koszta had been born in Austria, but had taken out his first papers as a citizen of the United States. While at Smyrna in 1854 he was seized by the Austrian authorities, on the charge of having, in some way, offended the Austrian government, and was taken on board the war-ship Hussar. The American sloop of war St. Louis, Captain Ingraham, lay in the harbor, and an appeal in behalf of Koszta was made to the captain through the American consul. Captain Ingraham at once demanded the man from the captain of the Hussar, but the Austrian, having the larger ship, declined to give him up. Ingraham at once, not troubled by the disparity in force, and heedless of diplomacy and official delay, laid his ship alongside the Hussar, to whose captain he announced that he would have the man within a fixed time or he would fight for him. The man was given up. Ingraham was voted a medal by Congress for his bold defence of the rights of American citizens.

A brief reference may be made to some other matters of interest in connection with the navy in the period covered by this chapter. In 1838 a naval expedition of five vessels, under the command of Captain Charles Wilkes, was sent out to make a scientific exploration of the far southern seas. It was absent four years, discovering what was claimed to be an Antarctic continent, exploring many islands and coasts, including those of western North America,

and returning in 1842 after making a voyage around the world. It was the first of the expeditions for the advancement of science made by the United States, and its results were of great value.

In 1847 Lieutenant William F. Lynch, of the navy, was sent on a government exploring expedition to the Dead Sea, and returned with much useful information concerning the conditions of nature in that region.

The various expeditions sent to the Arctic regions under the auspices of the naval department of the United States government began in 1850, with that conducted by Lieutenant De Haven in search of the Sir John Franklin expedition. In 1853 Elisha Kent Kane, surgeon under De Haven, conducted an expedition for the same purpose, and in 1860 Isaac I. Hayes made a third expedition to the same region. Success in the search for the remains of the Franklin party was finally obtained by Lieutenant Schwatka, an American army officer, in 1879–80.

CHAPTER V.

THE NAVY IN THE CIVIL WAR.

WITH the firing on Fort Sumter, in April, 1861, began the great American Civil War. It was a conflict mainly of land forces, but the navy played in it an important part, though under conditions widely different from those which it had met with in any preceding war. The contests were largely, though

not wholly, those of ships against forts, and took place in rivers and harbors instead of on the open sea. And war-vessels underwent a remarkable development, in which steam replaced sails and the wind as the propelling power, iron made impregnable the wooden walls of ships, and rifled cannon succeeded in some measure the old smooth-bore guns, which they far surpassed in power and range. These changes, however, were only in part; the new and the old met and mingled in our ships of war; it was the first stage in the new era of naval warfare, and the world looked on with astounded eyes as it saw its old theories set at naught and its dogmas of war on the seas converted into traditions. One memorable battle, indeed, completely transformed the conditions of naval war, that famous struggle of ironclads in the waters of Hampton Roads.

It is our purpose here to deal briefly with the naval events of the Civil War, confining our attention to its more striking episodes. For that reason we shall say little concerning the blockade, which continued throughout the war, but was marked by few exciting incidents. It was a service of waiting and watching, with the chase and capture of blockade-runners as its leading features of interest.

The first proclamation establishing a blockade was issued by President Lincoln on April 19, 1861, six days after the fall of Fort Sumter. On the 27th a second proclamation was issued, adding the ports of Virginia and Texas to those ordered to be closed, and thus extending the blockade to the whole coast-line of the Confederacy. The direct distance thus covered was more than three thousand five hundred miles, while the total shore line, including that of bays and

inlets, was nearly six thousand eight hundred miles in length, and the shore line of islands needing to be watched added about five thousand miles more. Within this distance were one hundred and eighty-five river and harbor openings which it was proposed to close to commerce; yet for this purpose, on the day the proclamation was made, the government had in commission the small total of twenty-six steamers and sixteen sailing ships, of which three only, the Pawnee, the Mohawk, and the Crusader, were at that time in the waters of the Northern States. There were, in addition, twenty-seven ships fit for service lying at the different navy-yards.

With this inadequate force the great blockade was begun. This state of affairs, however, did not long continue, ship after ship being added to the force, until at the end of the war over six hundred ships were employed in the blockade, though even these were not enough to close completely the Southern ports. The blockade-runners were vessels built for speed, and made their runs mainly at night, slipping through or around the blockading fleets, the profits of the service being so great that the risk of capture was freely taken, since a few successful runs sufficed to much more than repay the cost of the enterprise. Though over one thousand prizes were made by the blockading squadrons during the war, the efforts to run the blockade were continued until the last Confederate port had been captured and closed.

The cannon used on the ships at that time were far more powerful than had been employed in any earlier war. The Dahlgren smooth-bores were increased in size until guns of fifteen-inch diameter came

DESPATCH-BOAT DOLPHIN.

into use, the best ships of the navy being armed with powerful Dahlgren guns. The frigate Minnesota, for instance, carried no less than forty-two 9-inch Dahlgrens and one 11-inch, together with four 100-pounder rifles and one 150-pounder, and could throw at a broadside eighteen hundred and sixty-one pounds of metal. The broadside of the Merrimac carried fourteen hundred and twenty-four pounds.

The naval war began on May 31, 1861, with the bombardment of a battery at Acquia Creek, an event which was attended with much roar of cannons, but with no loss of human life and little damage to fort or vessels. On June 27 another conflict took place at Mathias Point, both affairs being efforts to prevent the Confederates from closing the navigation of the Potomac. On August 26 came on a battle of more importance, between a fleet and a land force, the purpose being the capture of Fort Hatteras. This, which was accomplished on the 28th, was the first victory gained by the Union side during the war. Not a life was lost by the Union forces in the assault, while the Confederate loss was very small. In November the fleet performed another valuable service, in the capture of the fine harbor of Port Royal, on the South Carolina coast. A stubborn defence was made, but the forts were captured with little loss of life. The two strongholds thus gained were held by the Union forces until the end of the war.

Meanwhile, the Confederates had been actively at work on the lower Mississippi in producing the first ironclad used in the war. For this purpose a large double-screw tug-boat was employed, whose hull was cut down almost to the water, while over the deck

was built a rounded roof, which was plated with bar iron one and a half inches thick. To convert the tug into a ram, the bow was filled solid with timbers for twenty feet back and plated with iron like the roof. To this first of American ironclads the first land battle of the war supplied a name, it being entitled the Manassas, in honor of the Confederate victory at the place of that name.

On the night of October 31, 1861, this nondescript craft made its appearance near the mouth of the Mississippi, where a small government fleet was guarding the channel. Coming down with the force of the current, the ironclad struck with her ram the flagship Richmond almost before the crew had taken the alarm. The damage done was slight, the Manassas suffering the most, since one of her engines was wrecked by the shock. But this new device in naval warfare seems to have thoroughly alarmed the captains and crews of the fleet, and they made their way in all haste down the river, while the ironclad, in equal dread of an attack in her weakened state, crept slowly back upstream under her unharmed engine. It was an instance of double alarm, which amounted to panic on the part of the ships, they hastening to the Gulf and leaving the whole river clear.

While this was taking place on the Mississippi two ironclads of different description were being made elsewhere. At an early date in the war steps were taken by the Confederate government for the building of a vessel of this character for use in the waters of Chesapeake Bay and vicinity, and plans for it were drawn. The abandonment of the Norfolk navy-yard by the government, and the burning and sinking there of the

steam-frigate Merrimac, gave the Confederate engineers a basis for their work. The partly burned hull was raised and cut down to the berth deck, and a deck of heavy timbers was laid over the entire hull. On this was built a sloping roof of timber, two feet thick, which was covered with a layer of iron plates two inches thick and eight inches wide, laid horizontally, and an outer layer of the same thickness laid vertically. The hull was plated with one inch iron for two feet below the deck. The projecting bow was converted into a ram by bolting to it, below the water-line, a cast-iron wedge that projected two feet from the stem. The battery of this formidable vessel consisted of six 9-inch Dahlgrens and four massive rifles of 7-inch caliber.

The work of building this craft was begun in June, 1861. The Union government was well aware of what was in prospect, but Congress and the naval board made such needless delay that it was not until October 4 that a contract was signed with John Ericsson for the building of an iron-clad ship. Designs had been called for, and three of these were accepted. The ship built under one of them proved a failure, from the poor fastening of her iron armor; another, named the New Ironsides, did excellent work a year or so later; the third, that designed by Ericsson, was the only one calculated to meet in time the coming exigency.

The delay of the officials was not emulated by the workmen. The new vessel was built with the utmost rapidity, three gangs of men being employed and working night and day. The craft which came into shape under their hands was of a pattern such as the world had never before seen. The lower hull, one

hundred and twenty-four feet long, thirty-four wide, and about six deep, was covered with a structure that projected beyond it on all sides, the projection being three feet eight inches on the sides and twenty-five feet at each end. This overhanging part was like a separate flat-bottomed hull laid on top of the lower one. It was one hundred and seventy-two feet long, forty-one wide, and had vertical sides rising five feet in height. The lower hull, which was made of boiler iron riveted to interior frame-work, was secured by a row of rivets to the upper one, whose projecting sides insured its safety from shots. The sides of the projecting part were protected by iron armor composed of five 1-inch plates securely bolted to a heavy backing of oak timbers, the vessel sinking in the water until little more than a foot of the armored side stood above the water-line. Great wooden beams stretched across supported a heavy timber deck, on which were bolted two layers of half-inch iron plates, as a protection against a plunging fire. From the centre rose a circular turret, twenty feet in inner diameter and nine feet high, supported on a pivot which could be easily turned by engine power. It was armored with eight 1-inch iron plates, and carried two 11-inch smoothbore guns, firing solid shot of about one hundred and eighty pounds weight. These were muzzle-loaders, but when loading the turret was turned so as not to expose their port-holes to the guns of an enemy.

Such was the general aspect of the Monitor, as this vessel was named, the strangest craft that eye of man had ever gazed upon. Sitting deep in the water, her deck rising but a foot above the surface, and with her round turret alone protruding, she justified the Con-

federate description of "a cheese-box on a raft." Interiorly she was well ventilated by steam fans and the men endured their confinement with some degree of comfort.

As the Merrimac and the Monitor neared completion a race arose as to which should be finished first, spies keeping both sides well informed of the progress made. As it chanced, they were made ready almost simultaneously, the Merrimac, however, possessing the advantage of being nearest the scene of proposed action.

On the morning of March 8, 1862, as the United States steam-frigates St. Lawrence, Roanoke, and Minnesota, the sailing frigate Congress, and the sloop of war Cumberland lay anchored at various points in Hampton Roads, a long trail of smoke rising in the direction of Norfolk gave warning of the approach of the dreaded ironclad, and the drums beat the threatened crews to quarters.

The attack was made on the sailing vessels, which lay not far apart and out of reach of aid from the guns of the fort. They poured the full fire of their broadsides on the iron monster as she approached, but all in vain, for their balls bounded from the iron hull "like peas from a pea-shooter." The fire of the Merrimac had a very different effect, spreading death through the wooden ships. Passing the Congress, the iron monster rushed at her highest speed upon the Cumberland, the armed bow crushing deep into the side of the fated ship. As she drew back, leaving her iron prow in the gaping wound, she fired every gun that would bear, while the water poured in a torrent into the Cumberland's hold. The wounded

vessel at once began to sink, but the men kept unflinchingly at their guns, firing the last shot as the waters were ready to close above the deck. Then to the bottom she went, her flag still flying, and such of the crew as survived swimming for the shore.

The Merrimac next turned towards the Congress. Here the shoalness of the water prevented the use of the ram, but the guns of the assailant poured such disaster upon this ship that a white flag was soon displayed. Commodore Buchanan, of the Merrimac, now ordered the two gunboats that accompanied him to take possession of the prize. But a sharp fire from troops ranged along the shore prevented this being done, and in the end Buchanan ordered the firing of red-hot shot into the ship, soon setting her on fire from stem to stern. As the flames enveloped the doomed victim the Merrimac turned and steamed back towards Sewell's Point. She had done enough for one day, but had not come off quite scot free, and her commander was content to let the remainder of his work remain for the following day.

But this day told a different tale. Late that afternoon Ericsson's strange little boat, the Monitor, steamed into the harbor, and took her position behind the Minnesota, prepared to do her work when the next day's sun should dawn. She was on her trial trip, her acceptance by the government depending on her performance in the momentous impending conflict. It need scarcely be said that there was no question about her acceptance after the next day's work.

The Monitor, however, was not made for storm. She had encountered a high sea on her passage down from New York, which threatened her with the fate

which she met with some months afterwards. Water poured through the hawse-pipe and dashed down the smoke-stack, until the fires were nearly extinguished. The fan-belts became wet and the draught was cut off, the engineers and firemen being half suffocated. The water deepened in the hold until the vessel threatened to sink, a disaster which would have proved fatal to the Hampton Roads fleet. Fortunately she reached smooth water without this fatal termination of her career.

Early the next day the Merrimac left her anchorage and steamed down the harbor, firing on the Minnesota while still a mile away. At once the Monitor shot out from her concealment and darted straight towards her bulky adversary, continuing her course until the giant and the dwarf lay closely side by side.

And now began the most momentous conflict in the history of the navies of the world, an epoch-making combat which rendered useless and antiquated all the existing fleets of the nations. The first ball from the Monitor struck the side of her antagonist with a mighty crash, breaking the iron plates as it bounded into the sea. The Merrimac fired back with no better effect than to dint the thick-shelled turret of the Monitor. Thus this strange battle began and thus it went on, the two iron ships hurling shot fiercely at each other, and each in turn trying to sink the other with a blow from her ram.

Of the two combatants the Merrimac suffered the most, many of her balls missing the turret of the Monitor, while every ball of the latter told. But a shell directed at the pilot-house of the smaller craft so disabled Captain Worden, who was using it as a

conning-tower, that the wounded officer gave orders to sheer off. This ended the battle. Before the Monitor was ready to return the Merrimac had withdrawn from the contest for that day and the strange duel was at an end. It had continued for several hours, during which the two ironclads had vigorously battered each other with little injury to their armored hulls.

The Merrimac was leaking badly, and considerations of safety demanded her retreat. She did not reappear in Hampton Roads until April 11, when she came down again and offered to fight, but the Monitor did not accept the challenge. The authorities at Washington did not care to risk this single safeguard, and had sent strict orders that she was not to fight unless forced to do so. The 10th of May ended the Merrimac's career. Norfolk was on that day abandoned by the Confederates, their famous vessel being first set on fire and blown, by the explosion of her magazine, to the winds. The Monitor did not long survive her. Late in December she was sent southward, and on January 2, 1863, was caught in a gale off Cape Hatteras and went to the bottom of the sea. Thus ended the story of the first fighting ironclads.

While these events were proceeding in the Atlantic waters, iron-clad gunboats for river service were being built on the waters of the West. These were prepared by James B. Eads, the famous engineer of later times, under a contract signed August 7, 1861, sixty-five days being given for the construction of seven boats. The boats built were light-draught, stern paddle-wheel river steamers, with sloping sides and ends, which were plated with 2½-inch iron. Each of them carried

NAVAL BATTLE BETWEEN THE MONITOR AND THE MERRIMAC.

thirteen rifled guns, capable of throwing a seventy-pound shell. The armor at the bow was heavily backed with oak, but was left unsupported in the rear, as the boats were expected to fight with their fronts to the foe.

These were named De Kalb, Carondelet, Cincinnati, Louisville, Mound City, Cairo, and Pittsburg. The snag-boat Benton was also converted into an iron-clad, the most powerful then in existence, and known popularly as the Old War Horse, while a similar one, the Essex, received its name from being commanded by William Porter, a son of Captain Porter of the old Essex. To these vessels were added the wooden craft Taylor, Lexington, and Conestoga.

This fleet of river boats saw much service on the rivers of the West and played an important part in the opening of the Mississippi to Union craft. We must, however, confine ourselves to a brief description of their work. The first naval fight on the Western waters was at Belmont, Missouri, where the Taylor and the Lexington attacked the Confederate works in support of a land attack by General Grant. But the first important service of the fleet was at Fort Henry, on the Tennessee, February 6, 1862, when, under Flag-officer Andrew H. Foote, it bombarded and subdued the fort before Grant, with the land forces, could arrive. On February 12 the leading vessels of the fleet reached Fort Donelson, on the Cumberland, and on the next day began the bombardment of that strong work. Foote arrived with other vessels during the night, and on the 14th the attack proceeded briskly. It ended in disaster to the fleet, as several of the boats were seriously injured by

the fire of the enemy. The victory was an army one, the fort being surrendered to Grant on the 16th.

Returning to the Mississippi, the fleet began the task of opening that stream. General Pope was marching to the attack of Island No. 10, a strongly fortified point, and asked Foote to send a couple of gunboats down by night past the Confederate batteries to cover his crossing. This service was one of great danger and Foote refused to take the risk, but he subsequently permitted Captain Henry Walke, of the Carondelet, to make the attempt.

Captain Walke prepared his vessel for the iron hail from the fort by placing extra planking on her deck, over which his chain cables were laid as armor. The engine and boiler were protected with cord-wood and the pilot-house was wrapped thickly with ropes. As a further protection a barge of baled hay was lashed to the exposed side. Thus equipped, on the night of April 10 the Carondelet lifted her anchors and began her perilous run just as a heavy thunder-storm came on. Unluckily for the bold adventurers, when they had arrived nearly opposite the batteries the soot in the smoke-stack caught fire and flames blazed redly into the air. A keen flash of lightning at the same time revealed the floating craft. The Confederates ran in all haste to their guns, whose roar soon vied with that of the thunder. But the gunners were confused and their eyes half blinded by the lightning's glare, and the gallant Carondelet passed by unharmed. This was the first "running of the batteries," a performance which became frequent in later days. The brave Walke has the credit of being the pioneer in this work of danger.

Island No. 10 soon surrendered, and the fleet passed

on to Fort Pillow, the next Confederate stronghold on the stream. Foote had been wounded at Fort Donelson, and Captain Charles H. Davis now took his place. Here the work of the river squadron assumed another aspect. Every day a mortar-boat was towed by a gunboat to a point from which it could throw shells into the fort, the gunboat keeping at hand to protect it. On May 10 the Cincinnati performed this service and remained near as a guard against the Confederate boats that lay below the fort.

An hour later the rising of a dense cloud of smoke gave signal that the Confederate fleet was out for a dash on the mortar-boat and her consort. The Cincinnati faced them alone, and for a time fought vigorously with three assailants, but, twice wounded by ramming, was soon forced to run into shoal water, where she sank. The other boats, meanwhile, were hastening to her aid and a sharp fight between the squadrons began, ending in a Confederate retreat, though the Mound City was also left in a sinking condition.

Fort Pillow was evacuated on June 4, and on the next day the Union fleet anchored just above Memphis, beside whose levee the Confederate vessels had taken refuge. In the early morning of the 6th began a new battle of the fleets. Colonel Charles Ellet had joined the government flotilla with seven river steamers which he had converted into rams, and two of these, the Queen of the West and the Monarch, dashed down the stream through the cloud of smoke and attacked the boats below.

In a brief interval four of the Confederate and one of the Union boats were on the bottom or had run

ashore. The remaining Confederate boats sought safety in flight, but one of them was sunk by shells and two were forced to surrender. Only one, the Van Dorn, escaped. The work of the rams in this contest had been efficient. Within about fifteen minutes three vessels had been sent to the bottom by ramming, while several others had been disabled by shots. The result of the fight was the surrender of Memphis and the opening of the river as far south as Vicksburg. Shortly afterwards, during an expedition up White River, Arkansas, the boiler of the Mound City was burst by a Confederate shell. Of one hundred and seventy-five persons on board, only twenty-five escaped unhurt from the frightful explosion. On June 29 the flotilla steamed down to Vicksburg and there, on July 1, met a Union fleet under Admiral Farragut.

We have already told how a Union squadron in the Mississippi fled in dismay from the Confederate ram Manassas. A new story was to be told in the succeeding year. An attack on New Orleans was suggested to the Navy Department by Commander David D. Porter, who proposed as leader of the expedition David G. Farragut, midshipman under his father in the old Essex fifty years before. The suggestion was accepted and Farragut appointed flag-officer of the fleet, and on February 20, 1862, he reached Ship Island, near the mouth of the great river of the West. The squadron under his command consisted of the bark Hartford, of twenty-four guns, the flag-ship, three screw sloops, a side-wheel steamer, three corvettes, and nine gunboats. In addition there were twenty mortar-boats, with six gunboats to protect

them, the latter flotilla being placed under Porter's command.

The Confederates depended for protection on two strong works, Fort St. Philip and Fort Jackson, which commanded the river at a point where it turned in a sharp, knee-like bend. They had also stretched a strong chain across the stream, and were supported by eleven steamers and a floating iron-clad battery called the Louisiana. The ram Manassas formed part of the fleet. To meet these formidable defences Farragut had only wooden vessels, whose resisting power he sought to improve by stretching chain cables over their sides, and guarding the engines by bags of coal, sand, ashes, and other materials. The mortar-schooners were disguised by lashing branches of trees to their masts so as to make them indistinguishable from the river-side trees. Thus prepared for the desperate struggle, the antagonists entered upon their work.

Beginning April 18, for six days the mortar-boats kept up a steady fire, while on the 20th Lieutenant Caldwell, in the gunboat Itasca, made a dash upon the river chain, which he succeeded in breaking. At two o'clock on the morning of the 24th of April the advance up the river began, the Cayuga, Captain Baily, leading the way, while the mortar-boats poured shells into Fort Jackson in a steady stream.

As the leading ships neared the forts, great piles of wood were fired and threw their lurid gleam far over the stream, while the forts opened with their hottest fire upon the daring craft. The first division drove through before the Confederates had fairly recovered from their surprise, but the second met with fiercer

opposition, having to fight not only the forts, but fire-rafts that came blazing down the river, and from which Farragut's flag-ship narrowly escaped.

The fight with the Confederate vessels was more severe than that with the forts. The Cayuga, the first to encounter them, was soon reinforced by others, and for some time a brisk battle went on. The Louisiana proved of little service, and the Manassas, after a vigorous effort to ram some of the Union ships, was run ashore and abandoned by her crew. The battle ended in the flight of the unhurt Confederate craft, the Union fleet following triumphantly up the stream and reaching the levees of New Orleans at one o'clock in the afternoon of April 25. The forts were surrendered to Porter on April 28, and a few days afterwards Farragut sailed on up-stream, passing Vicksburg, beyond which, as we have said, he met the flotilla of river boats.

During the succeeding year a number of naval operations of minor importance took place on the Mississippi, but the most striking event was that of the night of April 16, 1863, when Porter, then in command of the river fleet, ran the batteries at Vicksburg to the aid of General Grant, who had marched his army down west of the stream. Farragut had passed the batteries at Port Hudson a month before, and several successful single runs had been made past the Vicksburg forts, but this daring attempt was made with a fleet of twelve vessels. It proved remarkably successful, the rain of balls from the batteries only disabling one boat, the transport Henry Clay, which caught fire and sank.

The capture of Vicksburg put an end to active oper-

ations on the river, with the exception of Banks's Red River expedition of March, 1864, which was accompanied by Porter's river fleet. The principal event of interest connected with this was the fall of the waters of the stream, which left ten gunboats and two tugs helpless above the rapids, passed by them during the flood. There was serious danger of their loss, but they were saved by the ingenuity of Lieutenant-Colonel Joseph Baily, who had been a log-driver in Wisconsin, and knew how to deal with a difficulty like this. In a brief time he built a dam across the stream, by which he raised the waters sufficiently to float the boats and carry them through. Baily was thanked by Congress and made a brigadier-general for his skilful work.

With the story of how Farragut took New Orleans and Porter ran the Vicksburg forts and surmounted the Red River rapids, we have completed the account of the operations of the navy in inland waters during the Civil War. But Farragut's most famous exploit remains to be told,—the story of the great naval battle in the bay of Mobile. This bay extends thirty miles inland and is fifteen miles wide at its mouth, though sandy islands contract it until but a narrow ship-channel remains. The entrance was guarded by two strong forts, Fort Gaines on Dauphin Island and Fort Morgan on Mobile Point. The latter, which immediately commanded the channel, was a powerful work, abundantly provided with large smooth-bore and to some extent with rifled guns. The bay was further guarded by a number of gunboats and the iron-clad ram Tennessee, the most powerful floating battery built by the Confederate government.

The sides and ends of this vessel, built of heavy oak and pine timber, were inclined at an angle of forty-five degrees, and were covered with six inches of iron armor in front and with five inches elsewhere. She carried only six guns, but these were rifled cannon of eight- and six-inch aperture. Her principal defects were her lack of speed and the exposure of her steering-chains, which ran over the deck.

The Confederates had abundant time to prepare for the expected attack. The useless Red River expedition delayed Farragut by detaining the troops whom he needed to employ. For six months he was compelled to lie idle while the Confederates were completing their forts, finishing the Tennessee, and sowing the channel thickly with torpedoes, one hundred and eighty in all, a new element in marine warfare never before largely employed. Admiral Buchanan, who had commanded the Merrimac, was in command of the Tennessee, but for some reason unknown did not venture to attack Farragut's wooden ships.

In the end four monitors were sent to reinforce the Union fleet, and in the early morning of August 5, 1864, the long-delayed movement began, the wooden vessels being protected in the method employed in the advance upon New Orleans, while the smaller vessels were lashed on the off side of the larger. At 5.30 A.M. the signal to move appeared at the mast-head of the Hartford, Farragut's flag-ship, and by 6.10 the monitors were crossing the bar, followed by the fourteen wooden vessels of the fleet.

As the Tecumseh, the leading monitor, approached, she hurled balls from her two 15-inch guns at the fort. No reply was made. The Confederate fire was

withheld until it could be used at the shortest range, and then a hail of shot and shell was poured on the leading ships. It proved singularly ineffective, indicating very unskilful aiming, only a single shot in the whole affair doing any serious damage. The ships in return poured grape and canister from their guns, their purpose being to drive the Confederate gunners from their pieces, in which they were successful, the fire of the fort quickly slackening under this rain of projectiles.

The fort passed by the leading vessels, the Confederate fleet had next to be dealt with, the Tennessee opening fire on the monitor Tecumseh as she approached. Captain Craven, of the Tecumseh, in his haste to get at this powerful antagonist, left the channel which had been buoyed out for blockade-runners, and headed straight for the Tennessee, heedless of the torpedoes in his path. It was a daring but a fatal movement. Suddenly an explosion was heard, the bow of the monitor was lifted from the water, she lurched heavily, and then went down bow first, carrying nearly all her crew to instant death. A torpedo had rent her hull asunder. Of all on board, only the pilot and a few men escaped.

Regardless of the loss of the Tecumseh, the other monitors followed in her track, but the Brooklyn, that came next, halted, as little floats ahead showed that a nest of torpedoes lay before her. Her recoil checked the fleet, and held the Hartford under the hottest fire of the fort, one shot from which killed nearly a whole gun's crew. Farragut, who had taken his famous stand in the shrouds, just under the maintop, hailed

the Brooklyn as he came up and asked what was the trouble.

"Torpedoes," came back the reply.

"D——n the torpedoes!" he cried, in noble anger. "Follow me!"

A moment more and the Hartford was in the nest of death-dealing implements, whose percussion caps were heard snapping as she pushed through them. Fortunately they were badly made and not one explosion took place. The torpedoes passed, a dash was made for the gunboats, while the Tennessee drove into the midst of the Union squadron, trying, but in vain, to ram one after another of the fleet. She passed through with little harm done to either side.

Farragut, like Dewey at a later date, now ordered the men to breakfast; but word that the Tennessee had turned and was coming back sent the breakfast in a hurry again to the galley, and all the large vessels of the fleet prepared to meet their one dreaded foe. They gathered in a swarm around the Tennessee, so crowded in their efforts to ram her that the Hartford narrowly escaped being sent to the bottom by the Lackawanna. In the end the monitor Chickasaw completed the work. She cut away the exposed steering-gear, jammed the stern port shutters of the Tennessee so that they could not be opened, and seriously wounded her commander. Yet, though unable to steer or to fire a gun, the Tennessee for twenty minutes more endured the pounding of the fleet, at the end of which time the flag was lowered and surrender was made.

This ended the struggle. The forts soon afterwards were taken and the port of Mobile was closed to Con-

ADMIRAL JOHN L. WORDEN.

ADMIRAL DAVID G. FARRAGUT.

ADMIRAL DAVID D. PORTER.

ADMIRAL ANDREW H. FOOTE.

CAPTAIN RAPHAEL SEMMES.

ADMIRAL J. A. DAHLGREN.

NAVAL COMMANDERS IN THE CIVIL WAR.

federate commerce. The bay was swept for torpedoes, yet so thickly had they been planted that no less than three ships, two tugs, and a launch were afterwards sunk by them. It was good fortune to the fleet that those in its track had become useless.

While Farragut lay waiting outside Mobile Bay, there took place the one open-sea fight of the war. The privateer Alabama, which had done immense damage to Northern commerce, entered the port of Cherbourg, France, on June 10, 1864, and was there blockaded by the Kearsarge, Captain John A. Winslow. The ships were fairly matched in size and weight of metal, though the Kearsarge had the better guns. On the 19th Captain Semmes boldly left port to meet his antagonist, and soon a fierce battle was in progress, watched by thousands of spectators on the coast cliffs of France.

For nearly an hour the ships circled round each other, at close range, both firing with great rapidity. But the gunnery of the Kearsarge was careful and effective, while most of the shot of the Alabama went wild. In the end the Alabama, in a sinking state, headed for the shore; but the Kearsarge ran across her bow in position to rake her, and Semmes hauled down his flag. In a short time the noted privateer went to the bottom, though not before her crew was taken off, the captain and some of his men being rescued by the British steam-yacht Deerhound and carried off to England, where the bold Semmes was made a hero of and presented with a sword to replace the one he had lost.

Our next story of the war has to do with a Confederate ironclad, a class of vessel which the Confed-

erate government had proved active in building, but with which they had singularly ill success. We have chronicled the fate of the Merrimac, the Manassas, the Louisiana, and the Tennessee. There was still another, the Albemarle, built by a year and a half of labor on the Roanoke River and destroyed in one momentous minute by a daring Union volunteer.

The Albemarle, plated with four inches of iron, had two fights with Union ships, and put to flight all her antagonists except one, sending the latter to the bottom. Her prowess forced the surrender of Plymouth to the Confederate troops. As a second ship of the same character was building on Tar River, the Albemarle was now laid up beside a wharf at Plymouth to await this coming consort. It was expected that the two of them would be able to drive off the blockading fleet. At this critical juncture Lieutenant William B. Cushing, a young man of twenty-one, asked permission to attempt to destroy the dangerous ironclad. His plan was approved and the privilege given him to try.

On the 27th of October, 1864, the enterprise took place. In a torpedo-boat, consisting of a steam-launch carrying its torpedo at the end of a long spar, he started up the Roanoke, a boat-load of armed men being towed behind. It was a dark night. The launch with her tow moved silently up-stream. Unseen and unheard, they reached the front of Plymouth and approached the fated ship. To the disappointment of the daring adventurer he discovered that the Albemarle was guarded by a raft of logs stretching so far out that the spar could not reach her side.

Before any plan of action could be made the launch

was seen and hailed by the sentinels on the wharf, and, no reply being given, a fire of musketry came from shore and ship, while a bonfire of pine-logs was kindled and the ship's crew was called to quarters. The expedition might fairly have been called a failure, but Cushing was not that kind of man. Circling out into the stream, he drove the launch at full speed on the boom of logs. The bow rode up their sides, slippery through their long immersion, and forced them down; the spar passed under the hull of the ironclad and was lifted till it touched her side; and, as a cannon of the ship boomed above their heads, Cushing pulled the string connected with the trigger of the torpedo, and a louder roar answered from below. The Albemarle was lifted for an instant, and then sank to the muddy bottom of the stream, destroyed in a moment's touch.

Of the crew of the launch, only two were killed, the others, except two, being captured. One of these two was the gallant Cushing, who leaped overboard and swam to the marshy shore below. Creeping through marsh grass, corn-field, and woods, he gradually reached a safe distance, and finally captured a boat on a creek below, by the aid of which he made his way off to the fleet, having performed as gallant a deed as took place in the whole war.

We have nearly completed the record of the active efforts of the navy during the Civil War, though the blockade of Charleston presented some interesting events. To the Confederate ironclads named must be added two more, the Palmetto State and the Chicora, built at Charleston and in appearance resembling the Merrimac. By a sudden dash they forced the surrender of two vessels of the blockading fleet, but were

not able to take them into port. Later on two monitors had an encounter in Wilmington River with another iron-clad steamer called the Atlanta, which was captured after a fifteen minutes' fight.

The Confederates had proved as active as the Federalists, considering their comparative opportunities, in building ironclads. They had the credit of inaugurating a new method of warfare, that with torpedoes, which has now become so important an element of naval war. We have described the work of the planted torpedoes in Mobile Bay. The torpedo-boat was also invented by them, and tried at Charleston, before Cushing's successful employment of this new arm. A number of small torpedo-boats were built, which gained the distinctive name of "Davids" (from the story of David and Goliath), the torpedo-case, containing about one hundred pounds of powder, being carried on a spar in front of the boat. An explosive mixture was placed in tubes of lead, and prepared to go off at a touch. The first use of these boats was on the night of October 5, 1863, when a torpedo was exploded against the side of the New Ironsides. It struck the ship's armor, to which it did no serious damage.

Another of these boats, which it was claimed could move under water for half an hour without injury to the crew,—and which had drowned several crews in the experiment,—struck and sunk the Housatonic on February 17, 1864, the torpedo-boat going down with her victim. This, with the fruitless efforts of the fleet to silence the defences of Charleston, ends the naval record of the war for that locality, with the exception of the sinking by a torpedo of the monitor Patapsco,

January 15, 1865. Lieutenant (now Admiral) Sampson was senior officer of this vessel, and was highly commended for his courage in the affair.

The final naval expedition of the war was sent for the reduction of Fort Fisher, at the mouth of Cape Fear River, guarding the approach to Wilmington, North Carolina, the last fort open to the enterprise of blockade-runners. It was a strongly built and well-armed work, and long defied capture by the Union forces. A peculiar plan for its reduction was put into effect on the night of December 23, 1864, when, at the suggestion of General B. F. Butler, a ship containing more than two hundred tons of powder was exploded about three hundred yards from the fort. It was expected that the frightful concussion would destroy the works, or at least so affect the garrison that a determined attack would be successful. It did neither, and the subsequent bombardment by the fleet proved of no effect.

On January 13, 1865, Admiral Porter, in command of the fleet, made another determined assault upon the fort, having first landed General Terry with six thousand men. All that day and the next the ships poured shot and shell into the fort, and on the morning of the 15th opened fire again, covering the movement of the land forces, which dashed upon and carried the works. There were forty-two ships in the bombarding fleet, six of them being ironclads. Of the latter, five were monitors, and the other was the New Ironsides, of which something further may be said.

We have described the various efforts to build ironclad vessels made by the Confederate government, and the work done by them, and also spoken of the Union

ironclads brought into service on the Western rivers. For coast service a number of monitors were built, on the plan of Ericsson's first famous boat, the name of which they took as a distinctive title.

The New Ironsides was the first government vessel built at the now famous ship-yard of the Cramps, in Philadelphia. This vessel was ship-rigged, two hundred and fifty feet long, fifty-eight feet six inches beam, and drew about sixteen feet. She had engines of eighteen hundred horse-power, and under sails and steam could make about eleven knots. Her battery was composed of sixteen 11-inch Dahlgren guns and two 200-pounder Parrott rifles pivoted forward and aft, all being protected by sloping armor four inches thick. She took part in several actions against Fort Sumter, withstanding the heaviest guns of the fort, and was struck in vain by a Confederate torpedo-boat. At Fort Fisher she was anchored about six hundred yards from a bastion mounted with two 150-pounder Armstrong rifles. Yet she endured their fire without serious injury, finally dismounting one of them and silencing the other. No ship of the war-time navy saw more active service and none took part in so many actions. Her fate came upon her after the end of the war, when in 1866, while lying in ordinary at League Island, she took fire and burned to the water's edge.

In conclusion of this part of our subject, we may return to the story of the blockade-runners, which presents some features of interest. Although, as was said, the government had gathered before the end of the war a large fleet of blockaders, these were largely composed of yachts, tugs, coastwise steamers, and other types of vessels that could be picked up in our

ports, forming a curious aggregation of water craft. In fact, one of the richest prizes of the war, the steamer Circassian, was captured by a Fulton ferry-boat. The fleet improved in character as time went on, but during 1862, 1863, and the early part of 1864 the blockade-runners pursued a profitable career, their daring exploits presenting many tales of excitement and romance. The profits of the trade were great, the cotton that was taken out commanded a high price in British ports, and the bold captains of these fleet craft did not hesitate to make an impudent dash through the thick of the blockading fleet, risking death or capture in the allurement of the promised gain.

More than one of the captains of these craft gained wide-spread fame for skill and daring, among them "the notorious Captain Roberts," who had been in the British navy, and made many narrow escapes in his risky ventures. His real name was Hobart, and he afterwards, under the title of Hobart Pacha, came to the command of the Turkish fleet. Captain Wilkinson, in the Giraffe, a Clyde-built steamer, ran the blockade twenty-one times within ten months, and carried in and out hundreds of thousands of dollars' worth of goods. Captain Murphy-Aynsley, afterwards an admiral in the British navy, was one of the most intrepid of blockade-runners, and on one occasion carried his vessel, the Venus, through the blockading fleet and into Wilmington in broad daylight.

At first worn-out old boats were used, that would be little loss if captured, but as the blockade grew more effective this system proved unprofitable, and the swiftest and best-appointed boats were employed,—long, low, light-draught, side-wheel steamers, of good

freight-carrying capacity, their hulls rising but a few feet above the water and painted a dull gray or lead color so as to render them difficult to see. Anthracite coal was used, to avoid smoke, while their telescopic funnels might be lowered flush with the deck. Gliding noiselessly on through moonless nights, and before the idea of the search-light was born, it is no wonder that many such craft managed to slip safely into harbor.

Nassau, in the Bahamas, was the starting-point, and this sleepy old town for the time awakened to become a bustling and prosperous city. All the principal southern ports were entered, but principally Wilmington, the mouth of whose river was guarded by Fort Fisher, while its two inlets gave a double chance for a successful dash.

"The start from Nassau or Bermuda was usually made at such a time that a moonless night and high tide could be secured for running in. A sharp lookout was kept for cruisers on the outside blockade, and if one was met the blockade-runner took to his heels and usually got away. He never hove to when ordered, and in a tight pinch would rather heave his valuable cargo overboard, or even run ashore, than be captured. The most hazardous part of the whole run was when the runner had got fairly close in shore and had to make the final dash for the bar. The fleet of blockaders was always thick just before the bar, and the chances were manifold that the runner would get pocketed, sunk by a shell, or else driven ashore and burned."

The total number of prizes brought in during the war was eleven hundred and forty-nine, while a large

GUNBOAT HELENA.

number of vessels were sunk or destroyed, their cargoes, at a low estimate, being valued at $31,000,000. To make the business profitable, therefore, the number of successful vessels engaged must have been great. Many exciting stories of their adventures could be told, but we shall content ourselves with one story of a capture, told by J. R. Seley, an old naval officer, in his book on blockading. He says,—

"One of the prettiest captures made off Wilmington was that of the Ella and Anna, by Acting Master J. B. Breck, of the Niphon, in November, 1863. Breck was an officer of pluck and resource, and he won a name for himself by his dashing successes on the Wilmington blockade. About five o'clock on the morning of November 9, as he was returning along the shore from a chase near Masonborough Inlet, he discovered a side-wheel steamer to the northward, stealing along towards the entrance of the river. Outside of her lay a blockader, which opened on her with grape, and the blockade-runner, finding herself intercepted, steered directly for the Niphon with the intention of running her down. Breck saw the intention, and fixed on his plan in an instant. Heading for the steamer, he formed his boarders on the bow. The blockade-runner dashed on at full speed under a shower of canister, and struck him a blow that carried away his bowsprit and stem. In a moment his boarders were over the rail and on the deck of the blockade-runner, and in a few seconds made her a prize. She had on board three hundred cases of Austrian rifles and a quantity of saltpetre, and the prize sales netted $180,000. The Ella and Anna was taken into the

service, and in the next year, under her new name of the Malvern, became famous as the flag-ship of Admiral Porter."

CHAPTER VI.

RECENT NAVAL HISTORY.

THE close of the Civil War left the United States ill provided with ships likely to be of utility in the new conditions of warfare which that conflict had developed. In addition to the river-defence ironclads, built for use on the Mississippi and its tributaries, three types of vessels for open sea use had been devised during the war. Two of these, the Monitor and the New Ironsides, have been described. The third, known as the Galena, proved a failure, her 2½-inch plates being fastened on in so insecure a manner that they were easily racked or broken. This vessel proved her unsuitability in her first engagement before Fort Darling. The New Ironsides was burned, as we have said, immediately after the end of the war, leaving the monitors alone to represent our protected navy. A considerable number of vessels of this type had been built, and of these no less than thirteen still remained to be again called into service after being laid up in ordinary for nearly a quarter of a century.

The Dictator and Puritan, ordered later from Mr. Ericsson, were designed by him to be sea-going vessels of high speed and great coal-carrying capacity. Of these, the Dictator was completed, but only to dis-

appoint the hopes of her builder, she being found to be much heavier than expected and to sink so deeply as to have only two-thirds the proposed freeboard, or height above water. And the intended sixteen knots of speed sank to nine knots on her trial trip. The Puritan was left unfinished.

At the end of the war, however, the monitor idea still controlled the counsels of the Navy Department, and orders were given for the building of four sea-going ironclads of this type, to be named the Miantonomoh, the Monadnock, the Amphitrite, and the Terror. These were to be double turreted, to carry 6-inch side armor, and to be protected by twelve inches of iron on the turrets. Of these vessels, the Miantonomoh proved her sea-worthiness by safely crossing to and returning from England. They had been constructed of wood, and in 1874 were in such a state that it was decided to break them up and rebuild them in iron. It was this decision that gave rise to the monitors of the same names which form part of our existing steel-clad navy. The unfinished Puritan is also represented by an existing monitor of larger size ordered at the same time.

As most of these vessels were not completed and put into commission until 1896, and the war-time monitors lay in ordinary until 1898, the United States navy was left for many years destitute of sea-going vessels of utility in case of war. For twenty years, while the maritime nations of Europe were actively engaged in building fleets of powerful ironclads and making countless experiments with guns and armor, this country lay supine, the wooden ships that emerged from the war being her sole representatives upon the

seas. Some of these, under the admirable management of Farragut, had won fame in the Civil War, but the best of them could not have remained afloat for ten minutes before the powerful war machines which were beginning to dominate the seas. Useful still in times of peace, they had outlived their usefulness in war.

The steam-vessels of this fleet which remain serviceable include only the Hartford, Lancaster, and Monocacy, while half a dozen sailing vessels continue in special service, and there are rather more than a dozen vessels unfit for ocean use. Chief among the latter is the war-worn veteran, the Constitution, which was built in 1797, and carried off the highest honors of the war of 1812. She celebrated her centennial on October 21, 1897, and now lies, housed over, at Boston, kept as a precious relic of the early days of the republic.

During the interval that has elapsed since the war the officers of the American navy have made their mark in more than one region of the world, particularly in the Arctic seas, where they have played an important part in the work of exploration. Foremost among these was Lieutenant De Long, who served in an expedition to Northern Greenland in 1874, and in 1879 set sail for the Arctic Ocean, *via* Behring's Straits, in command of the ill-fated exploring ship Jeannette, which was crushed in the ice in June, 1881. The story of his brave struggle for life and the heroic rescue of the survivors of the party by one of their companions, Engineer Melville, belongs to the romance of Arctic adventure. Lieutenant Greely, who led the next expedition to the north, was an army officer, but

several naval expeditions were sent north for his rescue, which was at length achieved in 1884 by Winfield S. Schley, Commodore of the flying squadron of the American navy in the war with Spain. One further narrative of hardihood and adventure in the Arctic regions remains to be told, that of Lieutenant Robert E. Peary, of the American navy, who in 1892 made a brilliant sled journey over the interior ice-cap of far north Greenland to the eastern coast, discovering a range of land and sea never before seen by man. He repeated this daring adventure in 1895, and in 1898, under leave of absence from the navy, returned to the Arctic seas, to begin a series of journeys towards the pole, which were to be continued for years if necessary.

To return to the more direct history of the United States navy during the recent period, we may instance the seizure of Canadian fur-sealers in 1887, which led to a dispute with Great Britain that has since then been settled by arbitration. In 1889 the history of our ships was marked by a disastrous event. On March 16 of that year there lay in the harbor of Apia, in the Samoan Islands, a number of American, German, and British war-vessels, those of this country and Great Britain having been sent thither in consequence of the efforts of Germany to gain a controlling influence in those islands. On these vessels, at the date named, suddenly fell one of the terrific hurricanes which at times visit the Pacific waters; and when the winds fell the whole fleet lay wrecked with the exception of the British steamer Calliope, whose powerful engines had forced her to sea in the face of the gale. Of the American vessels, the Vandalia was

wrecked on a coral reef in the harbor, the Trenton was hurled on the beach, and the Nipsic was similarly driven ashore, losing her rudder and screw. The loss of these vessels was total except in the case of the Nipsic, which was afterwards floated and repaired. In this disaster more than fifty officers and sailors lost their lives. The Germans lost three vessels and a considerable number of men.

In 1890 General Barrundia, a citizen of Guatemala, and formerly minister of war of that republic, became involved in an unsuccessful conspiracy, and, pursued by the legitimate authorities, embarked as a passenger on an American packet steamer, the Acapulco. The Guatemalan minister of foreign affairs demanded his surrender, but the captain of the Acapulco, unwilling to yield his passenger to certain death, appealed to Commander Reiter, of the Thetis and the Ranger, two American war-vessels in the harbor, for protection. This Reiter declined to give, on the plea that he had no power to take such action in a foreign port without the permission of the naval authorities of the country concerned. The result was tragical. An officer with a squad of soldiers boarded the Acapulco for Barrundia's arrest, when the unfortunate fugitive, knowing that death awaited him, rushed from the cabin and fired a pistol at the officer and the captain of the steamer. He was at once shot dead by the soldiers.

This affair caused much indignation in the United States over what was considered a violation of the right of asylum, and Reiter was sharply disciplined by the Navy Department for his action. Sober second thought, however, put the matter in a different light,

and Reiter was restored to duty and the stigma upon his fair name removed.

The next event with which the navy was concerned took place in 1891. At that time there was an insurrection in Chili, which had made such headway against the legitimate authorities as to give the insurrectionists control of the port of Valparaiso and of a number of vessels, one of which was sent to San Francisco for a cargo of arms and munitions of war. The sailing of this vessel, the Itata, with her cargo of contraband material, was forbidden by the American authorities, such an act being in defiance of our obligations of neutrality. But the Chilian captain, in disdain of the authorities, set sail, carrying with him the port officer left on guard.

This open defiance of the United States was not relished, and the Charleston, one of our new cruisers, was ordered to pursue and bring back the defiant rebel craft. The Charleston was the faster vessel and made a sharp pursuit, diversified with an effort to stop her by the Chilian cruiser Esmeralda, which crossed her path and threatened hostilities. The gun-crews of the Charleston stood eagerly behind their shotted pieces, waiting in grim determination the word to fire. This word did not come; the Esmeralda was satisfied with the show of teeth by her antagonist and withdrew, and the Charleston kept on her way, running the Itata into harbor farther down the coast, where her captain surrendered her to the American representatives.

This event created a sentiment of hostility against this country among the Chilian insurrectionists, which was increased by their suspicion of complicity of the United States minister, Egan, with the constituted

authorities of the State. A serious affair resulted. On October 16, 1891, a party of sailors and petty officers from the cruiser Baltimore, being on shore leave in Valparaiso, were attacked by a violent mob of citizens. The unarmed sailors, being far outnumbered by their assailants and undefended by the police, sought safety in flight, but two of them were killed and a number seriously wounded by clubs and stones in the hands of the populace.

A judicial inquiry was made into this affair by the Chilian authorities, but it was dismissed as trivial, the soldiers being blamed as drunk and disorderly. Commander Schley, of the Baltimore, made a very different report, in which he exonerated the sailors from blame, and indignation ran high in the United States. It was added to by the action of the Chilian Secretary of State, who issued a circular couched in offensive language, in which he accused the American minister and naval officers of false statements. For the time being an active war spirit prevailed in this country, and war-vessels were prepared and sent out. This show of hostile purpose changed the tone of the Chilian authorities; an apology was made, the offensive circular withdrawn, and indemnity paid to the families of the victims. Thus ended the most warlike incident in American history between the Civil War and the date in question.

In 1894 another event occurred in which American readiness in dealing with a critical situation was strikingly shown. At that time a revolt, confined to the navy, was in progress in Brazil, the purpose of the revolutionists being, secondarily, to restore the monarchy, and, primarily, to advance the personal interests

of the leaders in the insurrection. The Brazilian navy was in possession of the revolutionists, who held the bay of Rio Janeiro, where much interference was made with the movements of peaceful merchantmen. The officers of the foreign war-ships in the harbor, with the exception of the Germans, favored the monarchical designs of the revolutionists, and practically accorded them the rights of belligerents, though they had not a foot of land under their sway. Saldanha da Gama, the rebel leader, threatened to fire on any ship that should go to the piers to discharge its cargo, and merchantmen were obliged to lie out in the bay and await the end of the war, despite the fact that yellow fever was decimating their crews.

The senior American officer present failed to interfere with this state of affairs and refused protection to merchantmen. Such was the condition of things when Admiral A. E. K. Benham appeared upon the scene, and took in the situation. He at once told the American captains to go to the piers and trust to him to protect them from harm or revenge them if injured. Inspirited by this promise, Captain Blackford, of the bark Amy, and two other captains, gave notice on Sunday, January 29, 1894, that they would take their ships in to the wharves on the following morning. Da Gama, hearing of this, made proclamation that he would fire on any vessel that ventured to do so, and a conflict seemed impending. Da Gama had a diversified lot of vessels under his command, most of them worthless as ships of war, but carrying fairly good guns. But among them was one good monitor, the Aquidaban, which was fully capable of giving a good account of itself if put to the test. There was a

state of excitement in Rio Janeiro harbor on the dawn of that Monday morning. Da Gama might be as good as his word, and the commanders of the war-vessels of other nations looked anxiously on to see if the American admiral would hold fast to his position. Day had hardly dawned before active preparations were visible on the small American squadron, which was soon cleared for action, the cruiser Detroit taking a station from which she could command two of Da Gama's vessels, the Guanabara and the Trajano, if they should venture to meddle with the Amy.

When the Detroit reached her station the Amy began to warp in towards the pier. From the Guanabara came a warning musket-shot. In an instant more a ball from the Detroit hurtled across the bow of the Brazilian vessel, followed by another that struck her side. These were in the way of preliminary admonition. Seeing a couple of tugs working inward as if with purpose to ram his vessel, Captain Brownsen took the Detroit in between the two Brazilian war-ships, occupying a position that would have enabled him to rake and sink them and their supporting tugs at the same time.

This decisive action ended the affair. No further shot came from a Brazilian gun, and the Amy, followed by the other two vessels, made her way unharmed to the wharves. The example was an infectious one. Before night had fallen the merchantmen under British and other foreign flags were hastening in the wake of the Americans, and the two warning shots from the Detroit proved to have put an end to an "intolerable situation" in Rio Janeiro harbor.

The history of the American navy, previous to the

outbreak of the war with Spain, ends with one notable event,—that of the greatest disaster in its total career, and one to which the subsequent war was very largely due,—the destruction of the battle-ship Maine. This was of such importance in its results as to call for a fuller description than we have given of other recent events. Riots in Havana, Cuba, which imperilled the safety of American residents, to whom the Spanish inhabitants of that city were bitterly hostile, led to the sending, on January 25, 1898, of the American battle-ship Maine to the harbor of that city, ostensibly on a friendly visit, but with the evident purpose of serving as a defence and refuge for American citizens in case of peril. Here she was assigned by the Spanish authorities an anchorage at a particular buoy, where she lay until the night of February 15, when in one fatal instant she was hurled to destruction and her crew into eternity.

On the morning of February 16 the whole American nation was startled with the news that during the previous night the Maine had been utterly destroyed by a terrific explosion, and then lay, a total wreck, on the bottom of the harbor, with nearly all her crew dead within her rent and ruined hull. The explosion had taken place about 9.45 of the evening before. The night was one of intense darkness. The Maine lay at anchor about five hundred yards from the arsenal, while about two hundred yards away lay the Ward Line steamer City of Washington and a little farther off the Spanish cruiser Alfonso XII. Captain Sigsbee was in bed in his cabin; Lieutenant-commander Wainwright, the executive officer, was in his own cabin smoking; the crew were asleep below; when, without

an instant's warning, came the terrible explosion that almost tore the vessel asunder and killed most of the men, under whose quarters it took place.

The force of the explosion was so great as to shake the whole water front of the city, put out the adjacent electric lights, and throw down many telegraph and telephone poles. Almost immediately afterwards a great flame broke out from the wrecked vessel, which illuminated the whole harbor, and showed to the hurrying people on shore the locality of the disaster. Search-lights were quickly thrown upon the waters, and boats were lowered in all haste from the adjacent steamers and rowed rapidly to the ruined ship. Captain Sigsbee and Lieutenant Wainwright were in a minute's time on deck, the captain's first order being to a sailor to flood the magazine. The man hastened away, did his work, but failed to return. Death had caught him at his task.

All the officers but two were saved, but of the ship's company of three hundred and fifty-three men only forty-eight escaped uninjured, and the roll-call of the dead in the end reached two hundred and sixty-six.

It need scarcely be said that the news of this terrible event intensified the feeling of opposition which had long prevailed in this country to Spain's methods in Cuba, and raised on the instant a strong war party, who instinctively laid the blame of the disaster on the government or some of the officials of Havana. Captain Sigsbee had enjoined patience until the cause of the disaster could be ascertained, but the people were in no patient mood, and the hostile sentiment intensified day by day.

A naval Court of Inquiry entered upon an exhaus-

SHIP'S COMPANY OF THE MAINE.

tive investigation of the affair, sending down divers to examine the hull of the Maine, then fast sinking into the soft mud of Havana harbor. These divers found abundant evidence that the cause of the explosion had been external, the bottom of the hull being driven upward to the level of the upper deck and the vessel nearly torn in twain by its force. The decision of the court was that, in its opinion, "the Maine was destroyed by a submarine mine, which caused the partial explosion of two or more of her magazines."

A hasty investigation made subsequently by the Spanish authorities led to the opposite verdict that the cause of the disaster was internal, and that the destruction of the Maine was due to the explosion of her own magazines. But this hasty and apparently interested decision had little or no effect on American public opinion, the mass of the people insisting that the loss of the ship and her crew was due to Spanish malignity, official or private, and that it was an outrage that called for expiation, not by the slow method of diplomacy, but by the quick and decisive method of war. The indignation of the people was roused to a pitch of intensity which had rarely been displayed in the United States, and though the war that subsequently came was based on different considerations, the popular sentiment as to its underlying cause was clearly expressed in the war-cry of "Remember the Maine," the tocsin call of the sailors during the great naval combat at Manila.

We are not here concerned with the naval events of the war that quickly succeeded the loss of the Maine, and shall devote the remainder of this chapter to a brief review of the progress of construction of

the new navy of the United States, which may be looked upon as one of the most important circumstances in American naval history.

Beyond the few early steps in the building of a navy in accordance with the newly developed principles of naval construction, and which went no further than the placing on the stocks of a number of double-turreted monitors, and the building of a few vessels that served as compromises between the old and the new styles, among them the Trenton, lost in the Samoan hurricane, nothing was done until 1881 by the United States government in the direction of restoring our navy to the position it occupied prior to 1861, at which time its ships had stood in general on an equality with the best of their classes throughout the world. The new movement began in 1881 with the appointment, by Secretary of the Navy William H. Hunt, of an advisory board to consider what should be done in the way of preparing a fleet in accordance with the position and needs of the United States. At that date there were on our naval list no less than one hundred and forty vessels, but of these, twenty-five were mere tugs and a large number of the others antiquated and useless. The new monitors had made little progress towards completion, the old ones were slowly sinking into decay, and there was not a vessel on the whole list fit for use in case of war.

Rear-Admiral John Rodgers presided over the deliberations of the new board, which was made up of able officers and issued a report that commanded general attention. This report was decidedly radical in its demands, and had its requirements been complied with the United States would have had to-day few or

no superiors in naval strength. It advised the construction of a fleet composed of twenty-one armored battle-ships, seventy unarmored cruisers of various kinds, five rams, five torpedo gunboats, and twenty torpedo-boats, all to be built of steel. This demand was far in advance of the time, the report was quietly shelved, and the United States navy is still much below the level thus boldly proposed. Instead of starting out on the grand scale advocated by this far-seeing board, the Navy Department went cautiously and tentatively to work, feeling its way year by year to more boldness and loftier ideas.

The succeeding Secretary of the Navy, William E. Chandler, suggested that obsolete ships should not be rebuilt or repaired if the expenditure necessary should exceed twenty per cent. of the original cost. This recommendation was accepted by Congress, and proved of importance in disposing of the time-worn hulks still dignified by the title of the American navy. During Secretary Chandler's term of office four vessels, the pioneers of the new navy, were built, on designs furnished by a second advisory board. These were the despatch-boat Dolphin and the partially protected cruisers Chicago, Boston, and Atlanta.

The construction of these ships was undertaken by John Roach, in his yard at Chester, Pennsylvania, the only ship-yard the government could find at that time fitted for such work. Of these, only the Dolphin was completed in this yard. What has since been acknowledged as unfair treatment by the Department caused the failure of Mr. Roach, and the cruisers were finished in government yards. At that time, indeed, the United States was destitute of facilities for build-

ing more than third-rate cruisers, and to obtain armor for these it was necessary to go abroad. These cruisers were provided with sails, the Atlanta and Boston being rigged as brigs, the Chicago as a three-masted schooner. Of the next two vessels built, the Newark and Charleston, ordered in 1885, the former was a three-masted schooner, and for the latter, the first to discard sails and possess only military masts, the government was obliged to go abroad for plans.

In regard to armament, the United States was as ill provided in 1885 as it was in regard to ships. At that date the armament of American war-ships consisted of smooth-bore guns, mainly of 9-inch caliber, with a few 8-inch muzzle-loading rifles and 60- and 80-pounder breech-loading rifles, the former converted from 11-inch smooth-bore Dahlgrens and the latter from 80- and 100-pounder Parrotts, relics of the Civil War. In 1885 forgings for guns of more than 6-inch caliber, together with armor-plate, steel shafting, and rapid-fire and machine-guns, needed to be obtained from abroad, and the general opinion concerning the American navy was in accordance with the following quotation from Mr. Frank M. Bennett:

"A sense of humiliation dogged the American naval officer as he went about his duty in foreign lands. In the far East, in the lesser countries along the Mediterranean Sea, and even in the seaports of South America, people smiled patronizingly upon him and from a sense of politeness avoided speaking of naval subjects in his presence. None but naval officers and a few Americans who happened to be abroad comprehended just how insignificant and cheap the great

republic appeared in the eyes of the world at and about the time mentioned."

In 1885 the Navy Department came under the control of Secretary William C. Whitney, and new life and activity were put into this long torpid branch of the government. A considerable number of vessels were ordered and efforts were made to bring the navy up to the European standard in all lines of achievement. It was felt that American workshops and workmen ought to be fully competent to produce all the requisites of naval construction, and every encouragement was held out to inventors, manufacturers, and ship-builders whose efforts promised success.

Steps had been taken in this direction in 1883, when the Gun-Foundry Board—Rear-Admiral Simpson presiding—visited the principal steel- and gun-shops at home and abroad with the purpose of determining the best method of manufacturing heavy ordnance for modern warfare, and in 1884 recommended that steel forgings and materials for guns be supplied at home by private industry. The question of producing armor-plate in this country had up to that time been little considered, but in 1886 proposals were issued for the supply of twelve hundred and twenty tons of gun forgings and six thousand seven hundred tons of steel armor, and in May, 1887, the contract for this was awarded to the Bethlehem Iron Company, the first establishment in this country in condition to vie with European workshops in the production of such material. The Carnegie Works at Pittsburg entered the same field in 1890, contracting to supply the government with five thousand nine hundred tons of armor-plate.

Since May, 1887, when the first contract for armor-plate was signed, the United States has developed remarkable facilities for naval construction of the highest grade and most massive character. American workmen have turned out steel armor-plates with surfaces so tough and hard that a drill cannot penetrate them, while the best armor-piercing projectile, eleven hundred pounds in weight, and "striking with a force sufficient to lift one thousand tons twenty-five feet, crushed in the backing of oak, but only dented the plate." Between 1885 and 1890 this country developed constructive plants capable of producing guns of from 8- to 16-inch caliber, steel armor of the highest grade and greatest thickness, steel shaftings for engines fit to endure any strain likely to be put upon them, rapid-fire and machine guns, and all other requisites for the completion of modern battle-ships of the finest and most powerful kind, without dependence in any particular upon workshops abroad. All this goes to prove what has been indicated in other directions, —that the mechanics and inventors of the United States are equal to almost any demands, and need but a brief interval to fit themselves to vie with the best of workmen abroad.

We may fitly conclude this chapter with a detail of the steps of progress of the Navy Department in the building of the existing American fleet. The order in 1883 for the ships already named was followed in 1885 by an act of Congress authorizing the construction of the cruisers Charleston and Newark and two gunboats, the Yorktown and the Petrel. In 1886 an important step was taken in an order for the completion of the five monitors, whose keels had been laid

twelve years before. In this year also was authorized the construction of the Texas, the first battle-ship of the new navy; the armored cruiser Maine, subsequently ranked with the Texas as a second-class battle-ship; the protected cruiser Baltimore; the dynamite cruiser Vesuvius, for the utilization of the newly-invented dynamite gun; and the Cushing, our first torpedo-boat, so named from Lieutenant Cushing, whose service with an improvised torpedo-boat in the Civil War has been already detailed.

The plans for the Baltimore were purchased abroad, though important changes were made in them by the builders, the Cramps, of Philadelphia. The Texas, of 6315, and the Maine, of 6682 tons displacement, were the first American ships ranked as battle-ships. They were built, however, with regard to speed, the first making a record of 17.80 and the second of 17.45 knots, these rates surpassing those possessed by or estimated for any of our larger battle-ships.

In 1887 five vessels were authorized by Congress,—the Monterey, the last ordered but, with the exception of the Miantonomoh, the first completed of the new monitors; the protected cruisers Philadelphia and San Francisco, each built in the city after which it was named; and the gunboats Concord and Bennington, built at Chester, Pennsylvania. The work of constructing a new navy was now fairly under way, stirred into life by the inspiring influence of Secretary Whitney, and in 1888 no less than eight ships were authorized. Most notable among these was the armored cruiser New York, a great advance in every respect over any cruiser before ordered, and one that has won for herself the high regard of the American people.

This was due alike to her speed, which reached the high level of 21 knots, her strong protection, and her powerful armament, which nearly assimilated her with the battle-ship in powers of offence and defence. The other vessels of the year were the protected cruiser Olympia, Admiral Dewey's flag-ship in the recent war, the protected cruisers Cincinnati and Raleigh, the cruisers Detroit, Marblehead, and Montgomery, and the training-ship Bancroft.

With the incoming of the new administration the Navy Department, under Secretary Tracy, followed the commendable example of Secretary Whitney and diligently pursued the work of giving the country a new navy. In 1889, indeed, only three vessels were ordered, two of them being gunboats, the Castine and the Machias, while the third was the most remarkable of our vessels, the ram Katahdin (originally known as the Ammen), the only craft of its kind in existence, with the exception of the British ram Polyphemus, and one whose value as a war-ship remains to be demonstrated.

It was not until 1890 that the government took steps to place itself fairly on a level with Europe in naval construction. Up to this date our battle-ships had been second-class in size and power, while among our cruisers the New York alone was fitted to vie with the best abroad. Measures were now taken to overcome this defect, three first-class battle-ships being ordered which it was designed to make equal in strength and armament with any in the world. This purpose was fulfilled in the authorization of the Indiana, the Massachusetts, and the Oregon, the first two built by the Cramps at Philadelphia and the last in the Union

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Works of San Francisco, the resulting vessels being fully competent to cope with any now afloat. The other vessels of the year were the swift protected cruiser Columbia and the torpedo-boat Ericsson. In the character of these vessels, built solely from American plans and of American material, the United States finally demonstrated that it had no superiors in the world in inventive ability and mechanical skill. In less than a decade it had developed plants for the construction of as powerful ships as the world possessed, and had afloat war-ships not surpassed in speed or power to give and take hard blows by any ships built abroad, while the Columbia holds the world's record for continuous sea-speed across the Atlantic, which she has crossed at the average speed of 18.41 knots for the whole distance. Her trial performance yielded a speed of 22.8 knots, the highest record up to that date.

In 1891 naval construction fell off, only one ship, the protected cruiser Minneapolis, a sister-ship to the Columbia, being authorized. She was built in the same yard, that of the Cramps, and on her trial trip even surpassed the Columbia in speed, making a record of 23.07 knots on a four hours' run. The year 1892 yielded two of the finest ships in our navy, the powerful sea-going battle-ship Iowa and the armored cruiser Brooklyn, a companion vessel to the New York, which she surpasses slightly in speed and size.

Three gunboats, the Nashville, the Wilmington, and the Helena, were ordered in 1893, and authority was given for the construction of the Plunger, a submarine torpedo-boat, of the Holland type. The falling off in activity in this year was continued in 1894,

whose record shows only three torpedo-boats, the Foote, the Rodgers, and the Winslow, adding somewhat to our very low strength in this important branch of the service. In 1895 activity was once more displayed, two first-class battle-ships, the Kentucky and the Kearsarge, being authorized, of a greater tonnage than any yet afloat. To these were added three torpedo-boat destroyers, the first in our navy of this new type, the Porter, the Dupont, and the Rowan. The year 1896 kept up this important work, three first-class sea-going battle-ships, the Alabama, the Wisconsin, and the Illinois, being authorized and put under process of construction. In the same year contracts were signed for the building of ten torpedo-boats, the Dahlgren, T. A. M. Craven, Farragut, Davis, Fox, Morris, Talbot, Gwin, Mackenzie, and McKee, to which were added in 1897 three others, the Stringham, Goldsborough, and Baily.

On April 1, 1898, three more first-class battle-ships were authorized by act of Congress, each to be of twelve thousand tons displacement, and four single-turreted monitors, while to the list of smaller craft were added sixteen torpedo-boats and as many torpedo-boat destroyers. Orders for a large number of this useful and quickly built class of boats were issued after the declaration of war with Spain, and before the end of the year 1898 the United States navy will have an abundant representation of this new type of naval craft, whose ability is least known and its possibilities more dreaded than those of any other class of vessels afloat upon the seas.

This rapid review of the progress of our new navy shows a highly creditable record. Fifteen years ago

this country was unrepresented by a single modern war-ship upon the high seas, and was destitute of the tools, the plant, or the knowledge necessary to the construction of such ships. All the costly and intricate requisites for the building of a modern fleet were wanting, and we stood almost at the foot of the nations in regard to our powers of defence in ocean warfare. We are not yet at the top, but are moving rapidly towards a proud position among the powers of the world, and possess to-day among our ships some of the most efficient yet produced. By the opening of the coming century this will be largely added to, and the United States is rapidly on the way towards taking rank among the leading sea-powers of the world.

PART II.

Our New Navy.

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CHAPTER I.

THE EVOLUTION OF THE IRONCLAD.

It is to Fitch and Fulton that we owe the first steps towards the development of the modern navy. Before their time, during all the ages of civilization, the only means by which ships could be moved were the oar and the sail. The employment of steam-power as an agent of propulsion radically changed the situation, and the war-ships of the present day defy the power of the wind. Two other agencies are of vital importance in the modern situation, iron armor and rifled guns, while of recent years the torpedo has come forward as a most important weapon of offence. The result of all these improvements is that the modern war-vessel is a strikingly different and vastly more powerful instrument of defence and destruction than the most efficient ship of war of a century ago.

Let us glance back at the fleet which Arnold gathered on Lake Champlain in 1776 to oppose the British invasion. The flag-ship of that squadron, the Congress, was a galley moved by oars, of the type of those used in Roman and Carthaginian wars, its eight guns throwing 6-pound balls to an effective distance

of about three hundred yards. A 24-pounder was then a monster of ordnance. But the great guns on the ships of to-day can hurl 1100-pound projectiles over a range of ten or twelve miles, with effective results at more than half that distance, and could in the interval of a few breaths have sent to the bottom the proudest ship of Revolutionary times. In no respect, indeed, has modern progress been more strikingly shown than in the development of the navy, and the great war-ship of half a century ago is almost as obsolete as Noah's ark.

The first step in this new development was taken by Robert Fulton in 1813 when he projected a steam ship of war that should be impregnable to the guns of that day. This ship was not launched until October 29, 1814, and the war ended before she was ready for service, the opportunity being missed of showing what steam could do against the wind. The Demologos, as she was named, was much the largest steamer then afloat, being one hundred and fifty feet in length and fifty-six in breadth, with a tonnage of 2475. She was practically composed of two boats, joined above, but with a wide canal below, in which revolved a paddle-wheel of sixteen feet diameter. Her armament was intended to be thirty 32-pounders, in addition to which Fulton proposed to supply her with 100-pounder columbiads, two suspended from each of the two bows, with the purpose of piercing an enemy below the water-line. A special engine was provided, with the novel purpose of hurling an immense column of water upon the decks and through the ports of an enemy —to drench out the valor of the crew by a douche of cold water.

This formidable vessel—for that period—found no opportunity of showing her powers, and was used as a receiving-ship at the Brooklyn Navy-Yard until 1829, when her magazine was accidentally fired and she was blown into fragments.

Another celebrated engineer, Colonel John Stevens, of New York, is credited with an important conception in the same year (1813), that of an iron-clad ship of a type in some respects like that of the Monitor. Its details were worked out for construction, but no further step was taken. The idea was in advance of the age. Yet it was not allowed to die out, for in a few years afterwards we find his son, Edwin A. Stevens, inaugurating a class of experiments which has become very common of recent years, that of the testing of cannon-ball against iron plate. His experiments were made with a 6-pounder bronze cannon. These early efforts were resumed in 1841, his target now being made of thin plates built up to the desired thickness. The conclusion arrived at was that four and one-half inches of iron sheathing were sufficient to resist, at thirty yards, a 64-pound shot from the marine guns of that period.

These experiments, the first definite steps towards the evolution of the ironclad, attracted the attention of the government, which instituted experiments at Sandy Hook. The outcome was an order to Robert L. Stevens, brother of Edwin, for a shot- and shell-proof war-steamer, plated with 4½-inch iron, for which Congress voted $250,000. This vessel, begun in 1844, had a remarkable history, costly and aggravating to its builders. A series of interruptions prevented its completion, the thickness of the armor was added to,

and in 1856, when the builder died, it remained unfinished on the ways. It resembled the monitor type of boat with the exception of the turrets, these being replaced by a sloping battery. As a ram it would have proved of great power. For years it remained at Hoboken partly finished, the boilers and twin-screw engines being in place. Edwin A. Stevens at his death left a million dollars for the completion of this pioneer ironclad, and in all the project cost the family nearly $2,000,000, yet the vessel was never launched, and in 1881 was torn to pieces and the materials sold. It had grown obsolete long before it was finished, yet to it must be given the credit of inaugurating the era of the iron-clad navy.

Another project for an armored war-ship was devised by Clinton Roosevelt, of New York, who suggested the building of a vessel sharp at both ends, "plating them with polished iron armor, with high bulwarks, and a sharp roof plated in like manner, with the design of glancing the balls. The means of defence are a torpedo, made to lower on nearing an enemy, and driven by a mortar into the enemy's side under water, where, by a fusee, it will explode."

The polishing of the armor of this proposed vessel, as we now very well know, would have been a useless waste of labor, but its absurdity could not be proved without trial, and in 1862 the armor of the Civil War ironclads was greased, with the notion that cannon-balls would glance off from a slippery surface. It was soon found that cannon-balls did not work that way. The torpedo idea, suggested by Roosevelt, has won its way remarkably since that date.

The propelling apparatus of early steam-vessels, the

paddle-wheel, was one that would have proved a weak feature in ships of war. Fulton recognized this at the outset, and built his steam war-ship with a double keel, the wheel being hidden in the space between.

In 1837 a new war-steamer was built to replace the old Demologos, and named the Fulton 2d. This vessel, one hundred and eighty feet long by thirty-five wide, had horizontal engines lying on her upper deck, and huge exposed paddle-wheels, twenty-two feet in diameter, their upper section standing high in air. Her armament was powerful for that day, but the exposure of her engines and wheel must have proved fatal to her effectiveness as a vessel of war.

Some device different from the paddle-wheel was evidently needed to render steam available for naval purposes, and it came in 1836, when the screw-propellor of John Ericsson was first invented. The utility of this important device was not acknowledged in England, where the patent had been taken out, and in 1839 Ericsson came to the United States, under invitation from Robert F. Stockton, who had made a trip on his model boat in England and was quick to recognize its value. In the same year Captain Matthew C. Perry ventured a prediction, which was laughed at by naval officers, that the sail was destined to become extinct on vessels of war. Their laughter was premature. Perry's prediction was realized much sooner than he had dreamed of. Aided by Stockton, Ericsson planned a man-of-war that should be driven by machinery placed below the danger-line and moved by a screw submerged at her stern. An appropriation was readily obtained from Congress for this vessel, and it was launched in 1843. The Princeton, as the

new ship of war was named, was one hundred and sixty-four feet long by thirty wide and twenty-one deep, and with two hundred tons of coal on board had a draught of nearly twenty feet. She was the first war-ship adapted to burn anthracite coal, and had various other features of superiority to her predecessors. Her armament included two long wrought-iron guns of about twelve inches bore, throwing balls of two hundred and twenty-five pounds weight, and capable, at a range of five hundred and sixty yards, of piercing fifty-seven inches of solid oak. Unfortunately, during her trial trip at Washington in 1844, one of these great guns burst, killing and wounding a number of passengers, among whom were the Secretaries of State and of the Navy.

This accident, however, only proved that forged guns of that size could not be safely made with the knowledge of the art then possessed, and did not affect the evident superiority of the screw as a propelling agent. The value of this device had been proved, and six more screw frigates—the Niagara, the Roanoke, the Colorado, the Merrimac, the Minnesota, and the Wabash—were built. To these were added six first-class, eight second-class, and five third-class screw sloops, giving the United States, at the opening of the Civil War, an excellent standing among the naval powers of that day.

As for the character of the guns used in this fleet, a description must be reserved for a later chapter. It will suffice here to say that the great Dahlgren smooth-bore cannon had become the favorite in the navy before the Civil War, guns of this make being used on the best ships. Rifled cannon had, however, been in-

troduced, made of cast iron with a wrought-iron jacket shrunk on the breech, and varying from 30- to 100-pounders. Rifles of larger size were soon produced. The frigate Minnesota entered the Civil War with an armament of one 11-inch and forty-two 9-inch Dahlgrens, one 150-pounder and four 100-pounder rifles, and was capable of throwing eighteen hundred and sixty-one pounds of metal at a broadside. The Parrott rifle, used in the Union navy, is said to have been surpassed in endurance by one known as the Brooke, produced by Commander John M. Brooke, of the Confederate navy, this being strengthened by two series of wrought-iron bands shrunk on over the cast-iron breech.

Such was the condition of the United States navy at the opening of the Civil War. Meanwhile, the idea of the ironclad had gone abroad, and other nations were instigated to work in the same direction. During the Crimean War England and France perceived the unwisdom of exposing wooden vessels to the fire of Russian forts armed with the new ordnance, and in 1854, ten years after the beginning of the Stevens battery, Louis Napoleon suggested the building of armored naval batteries for use in the Black Sea. Five such batteries were constructed in France, plated with 4½-inch iron. England built a number of similar ones, with 4-inch armor. Of these, only three of the French were completed in time to take part in the war, they being used in the bombardment of the strong Russian fort at Kinburn in the Crimea. At a distance of one thousand yards these batteries resisted 32-pounder shots propelled by 10-pound charges of powder. In less than half an hour the forts were silenced, and there

was no further need for these floating batteries during the war. They were flat-bottomed, keelless boats, one hundred and seventy-two feet long by forty-three feet beam, with engines of two hundred horse-power, their iron plating being backed by twenty inches of solid timber. They were heavily armed, carrying batteries of sixteen 68-pounders, but were crude and unmanageable affairs.

This experiment was followed in France by the construction of the first iron-clad ship ever actually completed, the celebrated La Gloire. This ship, based on an old frigate, the Napoleon, was two hundred and fifty feet long and fifty-five feet beam, her iron armor extending her whole length and reaching to six feet below the water-line. She was built with a ram bow, her speed being about 13.5 knots. She was completed in 1859, and was followed by two other wooden vessels of similar design, and by the iron ship Couronne. These ships were armored with 5-inch plates resting on twenty-six inches of wood backing, and carried a battery of thirty-six 5-ton guns. The completion of the La Gloire aroused England to the importance of iron-clad ships, and the Warrior, her first armored vessel, was launched in January, 1861. This ship was built of iron and covered for two-thirds of its length with 4½-inch iron plates, the two ends being left unarmored.

The Warrior was nearly double the size and tonnage of La Gloire, and, unlike the latter, is still fit for service, though long since obsolete as a fighting ship. She has a speed of nearly fifteen knots. Others quickly followed in which the plating covered the whole round of the hull, while several of the new line

of battle-ships were cut down, plated with iron four and one-half to six inches thick, and provided with ram bows. Such was the activity in the building of armored vessels that at the end of the Civil War in America the British navy possessed thirty ironclads of various types, and was once more superior upon the sea. On the breaking out of the Civil War, however, no such vessel, with the exception of the French floating batteries, had been tried in actual warfare, and the nations of Europe looked on with eager interest as this new type of fighting craft was put to trial. The conflict between the Monitor and the Merrimac in Hampton Roads was a revolutionary event in the naval history of the world. The results of the first shots in that momentous battle made obsolete all the navies of Europe except the few ironclads then possessed by France and England, and rendered necessary a multitude of costly experiments before the new principles of marine engineering could be evolved.

It is not necessary to say anything here concerning the ironclads of the Civil War. They have been sufficiently described in a preceding chapter. In their building the Confederates showed commendable promptness and much enterprise, though quick misfortune overtook every one of their ships. The unarmored vessel was still an element in the situation, Farragut having no others at New Orleans. Yet these were ill fitted to withstand the powerful guns then coming into use, and the activity in building ironclads showed clearly the feeling that the era of the wooden ship of war was at an end.

The close of the Civil War was followed by a period of indifference to naval requirements in the United

States, so long continued that this country was left in a worse position for ocean service than it had ever occupied. In the case of former wars, with the exception, already noted, of the Revolutionary War, the ships that remained were still of use, and formed the nucleus for the growth of a new navy. But after the Civil War a different state of affairs prevailed. The wooden vessels which emerged from that conflict were useless in the new conditions of ocean warfare, while the only sea-going ironclad, the New Ironsides, one of the most powerful war-vessels then in existence, was quickly destroyed by fire. The building of monitors had been active, and thirteen of these remained and still exist, useful for harbor defence, but unsuited for use on the open sea. It was in this condition that the United States entered the new era of ocean warfare, and in this condition it continued for twenty years, resting in sluggish inaction while armored war-fleets were being actively built by the nations of Europe, and experiments in the resistance of iron and steel plate were widely made. In considering, therefore, the evolution of the ironclad, we are obliged to go abroad, nothing having been done at home during the period in question.

It is claimed in England that the idea of the turret ship was not original with Ericsson. Captain Cowper Coles, of the British navy, proposed during the Crimean War a raft bearing a great gun, protected by a hemispherical iron shield. Ericsson, however, had submitted his conception to the Emperor Napoleon III. as early as 1854. By 1860 Captain Coles had advanced to the conception of a vessel like the Monitor, bearing a number of revolving cupolas or

turrets, each to contain two guns. They were to revolve on turn-tables. This idea is now in general use, all heavy guns either revolving independently on turn-tables, or turning in common with the turrets in which they are enclosed. Captain Coles, however, found the British admiralty deaf to his proposal; the broadside ship of the old navy continued the favorite form, and a number of ironclads were built of this old type.

To the Warrior were added several other vessels of the same character with unprotected ends, the Achilles being the first in which the armor was carried the whole length of the hull. The same was the case with the Minotaur, Northumberland, and Agincourt, in which the thickness of iron was increased to five and one-half inches in the central region, but the 18-inch wood backing of the Warrior was cut down to nine inches. Sail-power was still considered necessary, and these vessels had five masts. This gave them a curious appearance, and it is said that a merchant vessel sailed close up to the Minotaur during the night, its captain thinking, from the number of masts, that two vessels lay before him between which he might pass. To the newly built ships were added others cut down and converted from frigates of the old navy.

As guns increased in penetrating power, armor grew in thickness, the Bellerophon, begun in 1863, having an armor belt of nine inches. The Alexandra, which was launched in 1875, and was the last representative of the broadside system, carried armor twelve inches thick at the water-line opposite the machinery, tapering to six inches at the bow and stern. But the supreme importance of protecting the engines and other

essential parts of the ship was now fully recognized, and in the Alexandra armored bulkheads were carried from the ends of the heavy plating across the ship, completely enclosing its vital parts. The increasing thickness of armor was rendered necessary by the growing power of guns. The Warrior carried 68-pounders, weighing ninety-five hundredweight. In the Alexandra the main battery was composed of 18-ton guns, but above these were placed two 25-ton guns, of 12-inch diameter of bore. The twin screw had also been adopted, giving the Alexandra a speed of fifteen knots. This ship, the largest and latest of the broadside type, took part in the bombardment of the forts at Alexandria in 1882, where she was struck some thirty times, but received little injury.

Not only Great Britain, but European nations in general, long persisted in building ships of this character, innate conservatism keeping them to the old type, as it has similarly retained the old stage-coach type in the railway carriage. The advantages of the turret system, as indicated in the battle between the turreted Monitor and the broadside Merrimac, were slow in gaining recognition, though it is now universally accepted. It was considered that vessels of this type were unfit for distant service. They might, however, be of use in coast defence, as a species of floating fort, and a trial of two small monitors which were building in English ship-yards for the Confederate service, and were seized and afterwards purchased by the British government, induced a trial of this idea on a larger scale, and the construction of two turret ships was ordered. The Royal Sovereign, an old three decker, was cut down, plated with 5½-inch

iron, and provided with four turrets, of which the foremost held two guns, the others one each. The turrets, instead of revolving on a central spindle, like that of the Monitor, turned on rollers fixed on their lower edges. The turn-table system gave them greater rigidity of resistance when struck by shot, and is now everywhere adopted. This vessel was completed in 1864, and a similar one, the Prince Albert, was soon after launched.

These experiments were not satisfactory to Captain Coles. He insisted that a sea-going ship could be constructed on his principle, and the admiralty at length consented to build a turret ship with masts,—the Monarch. As this vessel did not embody the views of Captain Coles, he continued to advocate his plans, in which he was strongly supported by the press, and the admiralty finally permitted him to build a vessel in accordance with his conception of what a war-vessel should be. This craft, the Captain, had two turrets only, the growing weight of guns necessarily limiting the number of turrets. It was provided with three masts and had full sail-power. Unfortunately for Captain Coles and his plans, the low freeboard and great spread of sail of the Captain proved fatal to her, she being capsized in a squall off Cape Finisterre on September 6, 1870, carrying down nearly all hands. Among these was Captain Coles himself, who had taken passage on the ship for the purpose of observing its behavior.

This misfortune ended the career of masted turret ships. The Monarch was completed, but no other vessel of this type has been built. The two turrets of the Monarch were protected by 10-inch armor, while

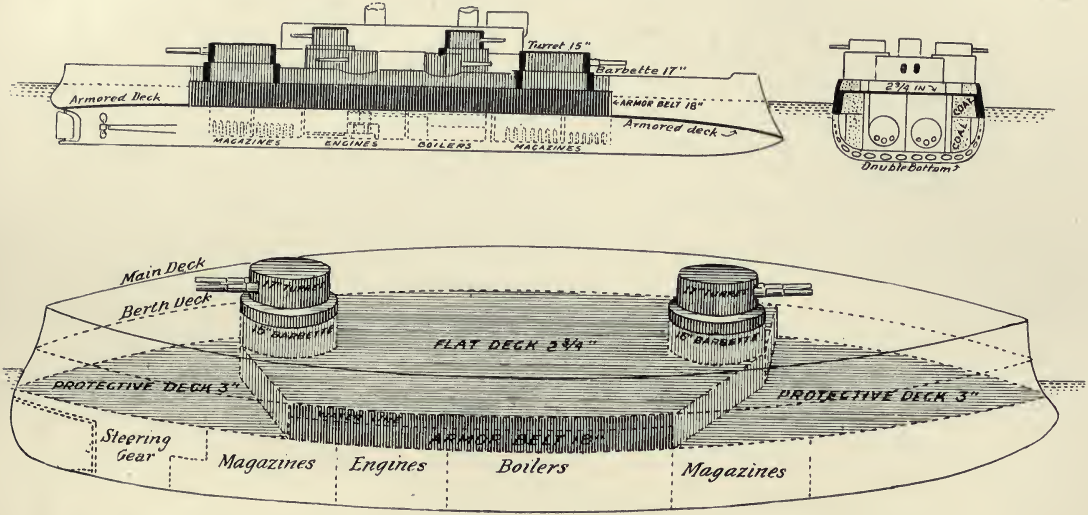
their lower portions were covered by the side armor of the ship. Each carried two 25-ton guns, the largest ordnance then in use. As the masts obstructed direct fire ahead and astern, smaller guns were placed at the ends of the vessel.

Though the ships named had shown disadvantages, owing to faults of construction, the superior merit of the turret system was gradually making itself felt. The mast must evidently give way if the turret was to be employed, but the latter presented advantages which could not but be acknowledged. The position of the turrets in the centre of the ship rendered easy an even distribution of weight of guns and armor, it being possible to mount much heavier guns in this situation than could be done in broadsides. And the turrets offered a far superior protection to the guns and the crew, both from the heavier armor they could carry, and the probability that many of the projectiles would glance from their rounded surfaces instead of penetrating. The low freeboard of a turret ship was also advantageous, as compared with the high freeboard of the broadside ship, in presenting a much smaller mark to an enemy. The result of these advantages has been that the turret principle has everywhere carried the day, and broadside ships of the old type are no longer built, though the two principles are often combined.

In 1869 three low freeboard, mastless turret ships were laid down in the British yards, the Devastation, the Thunderer, and the Dreadnought. These ships, of which the first named was completed in 1873, still hold a high place in the British navy. They have a belt of 14-inch armor at the water-line, above which

an armored breastwork of 12-inch iron reaches to the base of the turrets. The fore and aft freeboard is very low, the deck being but about four feet out of the water, so that water-tight hatches are necessary. A hurricane deck rises between and somewhat above the turrets and furnishes protection for many necessary appendages of the ship. These vessels, with all ships of the same type, are ventilated by means of fans worked by steam-power, on the principle adopted in the original Monitor.

The succeeding stage of development in the armored ship was the evolution of what is known as the citadel ship, in which protection of the fore and aft region is, in a measure, neglected and special attention given to the defence of the central vital section of the ship. The first stage in this lay in the athwartship armored bulkheads of the Alexandra and the Dreadnought. In the Inflexible, the first ship built in full conformity with the citadel type, the armor at the water-line was given the enormous thickness of twenty-four inches, in two thicknesses of twelve inches each, with wood backing between, while the turrets were protected with 16-inch plate. The side plates, however, were of wrought iron, while the turrets were covered with what is known as compound plate, iron faced with steel, which gave them a superior power of resistance. The citadel occupied but about one-third the full length of the ship, covering one hundred and ten feet out of the total three hundred and twenty feet, a breastwork extending from the ends of the armor across the seventy-four feet width of the ship. Its width was sixteen feet, it extending six feet five inches below and nine feet seven inches above the water-line. Ships



THE INVULNERABLE FLOATING FORT WITHIN THE OUTER WALLS OF MODERN BATTLE-SHIPS.

of this type, therefore, consist of a central, heavily armored cage or citadel, protecting all the machinery of the ship. Fore and aft from the base of the citadel extends a water-tight, turtle-backed deck, composed of steel two and one-half to three inches thick. Above this is built up a wooden portion, in which are the quarters of the men and officers. These unarmored ends can be destroyed without affecting the floating power of the ship or injuring its motive and fighting apparatus. Even the piercing of the armor below the water-line does not necessitate sinking, for the war-ship of the present day is made up of several hundred water-tight compartments, so that an aperture would admit the water to but a small portion of her interior.

In considering the evolution of the iron-clad ship of war, we have necessarily been taken abroad, the United States failing to aid in this evolution during the twenty years that succeeded the Civil War. But the work of evolution was not confined to Great Britain, the other nations of Europe taking active part in it. The close of the Civil War, indeed, was quickly followed by a battle of ironclads in the waters of the Mediterranean. This was in 1866, during the war of Prussia and Italy with Austria. At that date Italy possessed twelve iron-clad ships, varying in size from 5800 to 2000 tons, and protected with iron varying from four to five and one-half inches in thickness. Austria had only seven vessels of this kind, ranging from 5200 to 3000 tons, and with from 4¼- to 5-inch armor. It was also greatly inferior in guns. These two fleets, in company with a number of wooden vessels, met on the 20th of July, the Italian fleet the worse for a recent engagement with some land batteries, and

a hot engagement ensued. The battle continued for several hours, and ended in victory for the Austrians, the Italians being compelled to withdraw, with the loss of two of their ships. The principal loss of the Austrians was on the side of the wooden vessels that took part in the fight. It is of interest as the first open-sea battle between iron-clad fleets, but demonstrated nothing that had not been already shown in the American Civil War.

France had actively vied with England in building a new navy, and had adopted a somewhat different method of mounting heavy guns. The turret was employed, but there were added to it a few guns placed *en barbette* on each side. Eventually, when the increased weight of guns interfered with this double system, the French rejected the turret except for coast-defence vessels, and mounted all their heavy guns *en barbette.* The barbette consists of a thick inclined wall of armor, usually pear-shaped, built into the ship, and enclosing a turn-table that carries the gun, which stands on a platform (the original significance of the word barbette), high enough to enable the gun to be fired over the top of the wall or parapet. Thus the amount of protection is reduced, the full length of the gun being exposed to hostile fire, and only the apparatus for manipulating it protected. But while the turret gives greater protection to the gun, this advantage is reduced in the very long guns now used, since the greater part of their length must be exposed. In the Téméraire, a British ship to which the barbette principle was applied, disappearing guns were employed. But as this required a greater weight and larger enclosure, the disadvantage was held to be

greater than the gain, and the principle has not been applied to later ships, the use of the disappearing gun being since restricted to land forts. The final outcome of the movement in this direction, both in the British and French navies, is the existence of a series of vessels in which the barbette and broadside systems are combined, they being constructed with a pear-shaped barbette at each end for heavy guns, and between these a broadside battery of 6-inch guns. The British ships of this type, known as the "Admiral" class (being named after celebrated admirals), have eighteen inches of compound armor (iron faced with steel) at the water-line, and are built on the citadel plan.

There is another matter of importance that needs to be considered in this connection. Iron ships are more liable to injury than wooden ones in the event of striking a rock or the ground. In the wooden vessel the tendency to swell when water-soaked aids to close the fracture, an advantage not possessed by iron. To meet this danger, the double bottom was devised, an inner iron skin being placed a short distance from the outer bottom. This method has been developed until the inner skin has become a second hull under water, the space between the two hulls in some instances being as much as three and one-half feet in width. This is traversed by the ribs of the ship and by longitudinal divisions, so that it is partitioned off into a large number of water-tight cells. The piercing of the outer hull at any point could let no dangerous amount of water into the ship. In the event of both hulls being broken through, as by the blow of a ram or the explosion of a torpedo, the ship has still an

important safety provision in the possession of a large number of water-tight compartments. The number of these has enormously increased since the days of the New Ironsides, which possessed but three. They have reached as many as two hundred and seventy-two in the case of the battle-ship Indiana, and still more in some of the cruisers, the Cincinnati, for instance, having four hundred and eighty-seven such compartments,—water-proof steel boxes or rooms into which the vessel is divided up, and from which the water may be separately pumped.

While speaking of this, it is well to call attention to another water-proof device adopted in modern war-ships, for the purpose of preventing the entrance of water through shot-holes. This is accomplished by placing in the thickness of the side a layer of material which will expand when wet, swelling to fill the cavity made. A sort of coffer-dam is constructed for some distance above and below the water-line, and filled with this material. The British ship Inflexible, one of the first to be protected in this manner, possesses a layer made of a mixture of cork and oakum, and weighing one hundred and forty-eight tons. At a later date a preparation made from the husks of cocoanuts was employed, under the name of cellulose. This is a brown, fibrous substance, very light, and yielding largely to compression. It was first used in France, and was adopted in the United States navy in 1892. In 1895 a new cellulose was brought to the notice of the Navy Department, made of the pith of corn-stalks, which is granulated by machinery. This is cheap, light, incombustible, and more expansible when wet than the cocoanut product, swelling to fill con-

siderable rents. The one hundred and forty-eight tons of the Inflexible lining could be replaced by twenty-five tons of this material. It has been selected for the new battle-ships now building for the United States navy.

CHAPTER II.

THE MODERN WAR-SHIP.

It is proposed in the present chapter to deal in general terms with the subject of the war-ship as now understood, indicating its several varieties, and explaining the general meaning of terms. In old naval warfare a wide variety of names for ships came into vogue, the leading ones being those of "line-of-battle ship," "frigate," "corvette," and "sloop-of-war." Of these, the ship of the line, as it was otherwise entitled, was a powerful two- or three-decked vessel, carrying large and numerous guns, and forming the strong fighting nucleus of a warlike squadron. The frigate was a smaller ship with a single gun-deck, on which were ranged from twenty to fifty guns, but swifter than her great consort, and serving as an alert messenger or useful aid in the various exigencies of ocean warfare. These classes of ships played the relative parts taken by the battle-ship and the cruiser in modern war-fleets. The sloop of war was not a sloop in the sense of being a one-masted vessel, but might be either ship- or schooner-rigged, its armament varying from eighteen to thirty-two guns. Below it, as a war-vessel, ranged the brig, and above it the corvette, a three-

masted, square-rigged vessel, with one tier of guns, rarely more than twenty-six in number.

These various terms, and the others once in vogue, have, with the exception of gunboat, vanished from use within the past half-century, and are now replaced by a series of terms more in consonance with the conditions of modern warfare, some of them indicating classes of ships or smaller vessels new alike in naval nomenclature and naval usage.

One of the most marked changes in the aspect of ships is the disappearance of the sail as an agent to propel the vessel through the waves. Steam has succeeded the wind as the moving agent in navigation, and instead of adding sail after sail, as in the past, until the vessel was almost lost to view beneath her vast spread of canvas, modern ship-builders add horse-power after horse-power, with the effect of driving their vessels through the water at a speed undreamed of in the past and enabling the ship-masters of to-day to laugh at storm and calm and drive onward resistlessly in the teeth of a howling gale. The advantage in speed has been gained at a serious loss in picturesque effect. A full-rigged ship of the past, gliding gracefully onward with swelling sails and bowing masts, was a thing of beauty, a poem in motion, a white-winged bird of the waters whose floating grace inspired admiration in all beholders, until words became weak to express man's delight in the charm of the floating ocean swan.

From the modern war-ship all poetry has been stripped away. It is mighty, but not beautiful. The feathery grace of the ship under sail has been replaced by the grim lines of strength and massiveness. It is

force in motion that we see in the great modern steam-vessel, not floating beauty, and the poems now written in praise of the battle-ship speak of it as a grim instrument of destruction instead of a floating palace of beauty whose mission was masked by its grace.

The sail was yielded reluctantly. It was still of some use as a coal-saver, and continued to be spread to the winds, even while the strong engine was pulsing and revolving below. But as the demand for speed grew more vital coal won the battle over the wind and the sail gradually passed away. The mast has remained, but as a low iron column, of use only as a look-out point and to give a commanding height to some of the smaller guns of a modern armament. It has become the "military mast," and its old significance is at an end. As for the long rows of port-holes in an old-time battle-ship, each with its black, threatening muzzle, they have gone to return no more. The system of old was to plant as many guns in a ship as she could stagger under, with the hope of overwhelming an antagonist with the hail of iron balls hurled from her whole broadside in a devastating mass. A few great guns borne aloft in a steel-clad turret have replaced the grinning rows of the great two- or three-decker of the past, while a number of smaller guns, placed here and there, rain forth their instruments of death with such force and fury that the greatest ship of the line of Nelson's fleet, if placed within their range, would be rent into splinters almost before it could bring its broadside to bear.

The "wooden walls" of the past are no more. The iron citadel now holds the lordship of the seas. Steel has taken the place of wood, the rifled gun has sent

to the waste-heap the old-time smooth-bore, the breech-loader has relegated the muzzle-loader to antiquity, the quick-firing gun of the present has made obsolete the proudest cannon of the past, and modern naval warfare has made so vast a change that it is difficult to realize that the knell of the old system was first rung by the guns of the Monitor and the Merrimac, little more than a quarter of a century ago.

Fortunately for our sense of beauty, the high mast and swelling sail have not entirely vanished from view. War has no use for them, but peace finds them useful still. The great "liners" of the passenger service have no time for the vagaries and the deliberation of the wind, but the merchant service is not always in such headlong haste, and we may still see, floating up our rivers and gliding into our harbors, graceful representatives of the ship of the past which was seen everywhere before the inordinate demon of the furnace had robbed the winds of their olden task.

It must not be judged from the above remarks that the writer looks upon a modern battle-ship as a thing destitute of beauty. It has the attraction of strength and purpose. Utility is its distinguishing feature, everything has been stripped away but what is of direct use; but utility has always a charm of its own, and our "white squadron" has been justly admired despite the fact that it is shorn of the feathery, flowing grace of the battle-ship of the past. It has the grace of the athlete stripped for his work, and rid of the superfluous braveries of attire, and from this point of view is amply worthy of admiration.

The change in the make-up of the navy has come upon us so suddenly that the new names for types

of ships do not convey any definite meaning to many readers, and therefore some general explanation of them seems here in place. They read of "battle-ships," "cruisers," "monitors," "destroyers," "rams," "torpedo-boats," etc., in some confusion of mind, not knowing the significance of these several terms or what relation the ships thus named bear to those of the past. In truth, it may be said here that they bear almost no relation, except in their general warlike purpose, the ship of the line, frigate, etc., of our earlier wars having no strict counterparts in the navy of to-day.

First of all among the things with which a naval architect has to deal, in considering the building of a ship of a certain size, is the question of her displacement. This word, which may seem mysterious to many, simply indicates the number of tons of water a vessel will displace or force out when afloat upon a stream or at sea. The weight of the ship and its freightage cause it to sink to a certain depth in the water, forcing out a certain portion of the liquid to make room for its bulk, and the weight of this forced-out or displaced water, estimated in tons, constitutes the displacement of the ship, indicating its total weight in tons when sunk in water to its deepest load-line.

In all tabulated statements of ships will be seen the three terms, "displacement," "gross tonnage," and "net tonnage," an explanation of which at this point may not be amiss, as their significance may be unknown to many readers. By "gross tonnage" is meant the total carrying capacity of the ship. It is based upon the whole interior space, obtained by measurement and estimated in cubic feet. A "register" ton

is simply one hundred cubic feet of space, taxation on tonnage being based on the general allowance of one ton of freight to that amount of space. In estimating net tonnage allowance is made for the parts of the ship not used for freight or passengers. In sailing vessels this represents the space occupied by the crew, which may make little reduction in the gross tonnage. But in steam-vessels, where the space occupied by engines, boilers, coal, etc., is considered, about thirty-five per cent. needs to be deducted from the gross in estimating the net tonnage.

It is evident that by this method the actual weight of a loaded ship cannot be obtained, since much more than a ton of merchandise may occupy the one hundred cubic feet of space. There is another system of measurement, known as "freight tonnage," employed by merchants and shippers to represent stowage capacity, and differing from "register tonnage," forty cubic feet of space representing a freight ton. But this is similarly arbitrary, since the weight of cargo in a fixed space depends on the character of the goods, and may greatly differ with different goods. In naval ships, therefore, it is customary to use displacement tonnage, estimated by the depth to which a ship of war will sink when carrying its full load of guns, ammunition, men, and other variable equipment, and the weight of water it displaces in thus sinking, this weight being precisely equal to the total weight of the ship and its cargo.

As above said, the question of displacement needs to be carefully considered by the naval architect. The displacement tonnage must be properly distributed among the various elements of the ship and its load,

part being given to the hull, part to its weight of armor, part to its guns, and the remainder divided up among its engines and other machinery, coal and other stores, furnishing, and general equipment. This allotment of weight needs to be judiciously made. If it is found necessary to add to one portion of the weight, a deduction must be made from the others, so that the ship shall not sink below the estimated depth. Some of the elements of equipment cannot vary much, but there may be considerable difference in the weight of guns, armor, engines and coal-supply, and these require to be varied in accordance with the purpose of the ship. For instance, if great speed is demanded, so much of the available weight must be given to the engines and other parts of the machinery of motion that the weight of armor and guns is obliged to be proportionately reduced. If less speed is wished for, the weight taken from the machinery can be given to the armor and guns, a side armor and heavy turrets being added to the ship, with a greater weight in guns and ammunition. Again, if the main purpose is to produce a very powerful war-ship, the means of driving the vessel rapidly through the water must be reduced, and the weight taken from the machinery added to the armor and guns, a foot or a foot and a half of solid steel protecting the hull and the turrets, while great cannon, weighing sixty or more tons apiece, may be employed as weapons of offence.

What is above said indicates the main distinction between the battle-ship and the cruiser. The modern BATTLE-SHIP is a great floating engine of war, with a speed of, say, sixteen to eighteen knots an hour, but with armor of immense resisting power surrounding

every portion of the central section of the ship, and enclosing its engines, guns, and ammunition, the guns —which are the most powerful that any ship can carry and use with safety and effect—being further protected by great turrets or thick shields of steel. The largest guns now used on forts could not be fired from a ship without serious danger to the stability of the ship itself, but our battle-ships carry the largest that they can safely employ. Such is, in general terms, the battle-ship of to-day, a great floating citadel, intended more for coast defence than for open ocean warfare, yet capable of daring the fury of the waves, and able to bear a vast amount of bombardment without serious injury.

The greatest danger to which such a ship is exposed is from under-water attacks by the torpedo, the ram, or the mine, or being penetrated at the water-line by fire heavy enough to break through its armor belt. This peril is guarded against by several expedients, which will be more fully described in later chapters, and need but be glanced at here. At the water-line a backing of "cellulose" is provided, this being an expansive substance that swells when wet, and acts to close any opening and exclude the water from the ship. For bottom protection the hull is made in two parts, with a considerable space between, which is divided up into numerous water-tight compartments. In case of both sections of the hull being broken through, every enclosed space within the ship is made water-tight, so that no single rent in the bottom could let in water enough to sink the ship.

In addition to the side armor and that of the barbettes and turrets, the deck is also made of steel of,

usually, about three inches in thickness, which no ball is likely to strike in the direct line necessary for penetration, most of the missiles striking it being deflected and expected to glance off into the sea. This covers the central, box-like citadel, which is composed of the two walls of side armor and two transverse walls crossing the ship fore and aft and joining the ends of the side belts of steel. From these walls protective decks extend below the water-line to the two ends of the ship. A vessel thus loaded with armor and guns is necessarily very heavy, its speed being diminished in proportion, nearly all first-class battle-ships having a displacement of ten thousand tons or more, and some of those in foreign navies running up to nearly sixteen thousand tons.

A battle-ship is, in brief, a floating colony of steel, which, if placed in an ordinary city street, would fill a square or block from end to end and side to side, rising to or above the roofs of the houses, inhabited by some five hundred men, and enclosed in steel from three to eighteen inches thick. Its speed averages about fifteen knots an hour, and its armament is composed of guns ranging from the great 13-inch rifle, with its 1100-pound projectile, to the Gatling of .23-inch bore pouring out bullets of ¾-ounce weight.

The MONITOR is in its way a battle-ship, but one of distinctively different type from that described. It is more decisively than the above a coast-defence vessel, its slow speed rendering it of minor value for cruising purposes, and its low freeboard (or height of the side above the water) making it none too safe to trust at sea. The original Monitor was in imminent peril of foundering during her first voyage from New York

to Hampton Roads. What the result of such a disaster—one leaving the Merrimac free to work her will—would have been it is impossible to say. In her last venture in open waters this epoch-making vessel encountered another storm and went to the bottom of the sea. Fortunately, her work was done. The monitor has the armored side and deck and the steel-clad turrets of the battle-ship, but differs in its free-board, which varies from a few feet to only a few inches in height. It also lacks a powerful secondary battery, depending upon its few great guns, two of these forming the entire armament of the early, single-turreted ships of this class. The more recent monitors of our navy are better provided with means of offence.

To make a good sea-going vessel of a monitor it would be necessary to add one or more decks, building her sides up out of the water, and to lift the turrets correspondingly in height. But a vessel thus treated would cease to be a monitor, and could claim its place among the battle-ships.

The CRUISER constitutes a third class of war-vessels, in which the requirements of offence and defence are in a measure subordinated to that of speed. These are of several classes, distinctively known as "armored," "protected," and "unprotected." A typical example of the armored class is the New York, whose sides are protected amidships by a belt of steel armor of 4-inch thickness. The turrets and the barbettes from which they rise are also protected, but all this armor is much lighter in weight than in the battle-ships, the requisites of lightness and speed being of first importance. The deck is protected by a plating of 3-inch steel, which curves downward at the sides and there be-

comes of 6-inch thickness, extending downward to several feet below the water-line. The New York, therefore, has below her deck level amidships nine inches of solid steel, whose resistance is further added to by about six feet of coal in the adjoining bunkers.

The protected cruiser differs from the above in having no side armor, its sole protection being its armored deck with its down-sloping sides, and the coal bunkers to shield its central parts. These vessels lack also the barbettes and turrets, their guns being protected only by shields of steel or steel casements built out from the hull. The third class of cruisers, the unprotected, have no armored protection, except for their guns, depending upon speed to escape too strong an enemy.

It is to its speed that the cruiser owes its safety from the battle-ship, which is far beyond it in powers of destruction. It is its duty to search all seas for the enemy's ships, to destroy or capture merchantmen, keep the battle-ships advised of the movements of hostile fleets, and perform the general scouting duties which the frigate did for the line-of-battle ship of former navies. It may serve to convoy fleets of merchantmen, dash at top speed to convey important information quickly, and take its part in battle where ships of its own class are to be met. Armored cruisers, like the New York and Brooklyn, may on occasion try conclusions with battle-ships, with some hope of success, and our coming navy is likely to contain more vessels of this useful intermediate type.

For the special duties of the cruiser powerful engines are necessary, with provision for a large coal-supply, that she may keep the sea for a long period.

She needs a high freeboard, to adapt her for rapid steaming in all weathers; fine and fair lines, to give her high speed; ample space for the accommodation of a numerous crew, some of whom may be needed to take charge of prizes; and, finally, a powerful battery of guns of medium caliber, that she may give a good account of herself with ships of her own class. Such are the characteristics and requisites of the ships which make up the greater part of our existing navy.

It must be said, in conclusion of this section of the chapter, that battle-ships and cruisers show a tendency to run together at their dividing line, there being no hard and fast limits of distinction. For instance, in the Viscaya we have a Spanish cruiser carrying 12-inch armor and provided with guns of 11-inch caliber, while, on the other hand, the Japanese battle-ship Yashima, with the large displacement of 12,370 tons, is credited with a trial speed of nineteen and one-half knots. Finally, the unfortunate Maine was built as an armored cruiser, but when completed was placed on the official register as a second-class battle-ship.

Of ships of specially new design, born from the exigencies of modern warfare, may be named the armored ram, of which there are only two, specially restricted to this purpose, in existence, the British Polyphemus and the American Katahdin. The use of the ram itself, as an addition to the prow of a vessel, is of ancient date, it having been employed in the wars of Greece and Rome. It has been much considered in modern ship-building, though its service hitherto in warfare has not been great. What the Katahdin, built solely for this purpose, is likely to effect in actual battle remains to be demonstrated.

STEEL ARMORED RAM KATAHDIN.

Another boat peculiar to the American navy is one armed with tubes for the discharge of dynamite bombs against a hostile vessel. The utility of this vessel in actual service is much doubted, and the suggestion to convert it into an ordinary gunboat has been frequently made.

The TORPEDO-BOAT is, like the ram and the dynamite boat, a result of the conditions of modern warfare. The torpedo as an agent in war came into use in the Civil War, in some cases as a sunken bomb, and in two instances as a torpedo borne by a boat, these being the occasions of the sinking of the Housatonic by a Confederate craft and of the sinking of the ironclad Albemarle by the gallant Cushing. In both these instances the torpedo was carried on the end of a spar in the prow of the boat, but the modern torpedo-boat discharges its destructive missile from a gun capable of driving it for some distance through the water. These boats are of small size and great swiftness, their mode of warfare being to creep on a hostile ship under cover of night, discharge their death-dealing weapon, and glide away as rapidly and silently as they came. The torpedo-boat is the most dreaded type of modern war-vessels, her powers of destruction being great as compared with her diminutive size, and ships of war are kept on the *qui vive* at night to prevent the stealthy approach of these agents of terror.

As a counter-agent the torpedo-boat destroyer, or, briefly, the DESTROYER, has been devised, a boat designed to make thirty or more knots per hour, and to run down and destroy, if possible, the diminutive foe of the great floating citadel of war. In the evolution of modern fleets still another step has been taken

in this strange series, in the appearance of the destroyer of the torpedo-boat destroyer, designed to play the same hostile part against the latter as it plays against the torpedo-boat itself, and the latter against the great ships of war. Where these successive steps of destructiveness will stop it is not easy to say, but it may be taken for granted that the evolution of modern ships of war has not yet reached its ultimate stage.

A modern war-ship is not intended as a destroyer of towns. It carries a limited supply of ammunition, its great guns rapidly exhausting the magazines. It therefore cannot fire much without peril of being caught by a hostile ship with a short supply. And its stock is made up in considerable part of armor-piercing projectiles, useless, if solid shot, in attacking towns, and unsuited for this purpose if shell. Each shot might be worth much more than the damage it would be likely to inflict. Towns are therefore not likely to be attacked without strong necessity, and there is little danger of war-ships wasting their ammunition on undefended sea-coast places through sheer desire to inflict injury. If they have hostile fleets to meet, they cannot afford to waste the sinews of war in idle by-play like this.

In contending with fortifications ships of war now stand much farther off than formerly. In the Civil War grape and canister were used effectively by forts at the short range within which ships then ventured. At long range the chief peril lay in bursting shells and flying splinters. At present huge shells from high-power guns will come on board at several miles' distance, and at a discouraging rapidity, it being possible

to load and fire the great 12- or 13-inch guns once nearly every three minutes. At a little under two miles the fire from the 5- and 6-inch rapid-fire guns begins to make itself seriously felt, aimed shots coming at the rate of seven or more a minute. Farther in the 6-pounder begins to pour in its fire at the rate of forty shots a minute, and finally the machine 1-pounders and Maxim-Nordenfelt guns empty their hoppers at the frightful rate of two hundred per minute. The rain of shot and shell from such a ship or fort is something fearful to contemplate.

On board ship no place is safe. The marines in the military tops are likely to be swept away. The coal-passers and engineers below are in danger of scalding from punctured boilers. The captain in his steel box is in special peril. No member of the crew is safe. And any wood-work on the ship is in constant danger of being set on fire, for which reason, in late construction, great care is taken to use as little wood in exposed situations as possible.

In the words of a recent writer, a ship of war is like a floating village. It has to house, feed, and give employment to its inhabitants, who, unlike villagers, are constantly kept on the alert to face unknown conditions, and are trained to do so with unflinching coolness and courage. This moving community, with its five hundred more or less of inhabitants, is a realm of alertness and vigilance. Its people are expected to be always ready to face some contingency as startling as a midnight alarm of fire on land. Such is their discipline that they are expected to rouse from slumber and be at their post of duty within a very few minutes, ready to perform the special work to

which they are assigned. And this is not solely the exciting work of manning guns and facing the enemy. There are many who see nothing of the fighting, yet who take full risks with those in the thick of the fray; men who feed the fires, hoist the ammunition, and do other unseen labors, not knowing what is being done above, and whether their ship is winning the victory or is being torn to pieces by the enemy's shot, and likely at any moment to be sunk by mine or torpedo, torn into fragments by an exploding magazine or filled with scalding steam from a pierced boiler.

Yet all are expected to keep to their posts and calmly perform their duty regardless of all this, to act like arms and fingers under the direction of the brain that occupies the conning-tower, to act, not to think, unless some unusual contingency arises, when an American sailor is expected to use the intelligence and the readiness which distinguish the American character. Discipline on such a ship must be rigid and unremitting. Its family of seamen and artisans must move together as one man. Eternal vigilance is the only assurance of safety, and laxness in action or ignorance of duty when the supreme moment arrives may prove the factor that brings sure and swift ruin, while in able adaptation to the situation safety is likely to dwell.

A modern battle-ship has grown to be an automatic machine, an instrument of warfare in which almost nothing is done by hand. There is no longer hasty leaping about from post to post; flying to mast-tops to set or furl sails; dashing to the gun-deck to haul the guns in from their ports, thrust in powder and balls and ram them home; carrying up the ammunition to

the gun-decks by hand; rushing about in seeming confusion, every man ready to turn his hand to a dozen things at once. Then all was done by hand and all in tearing haste. Now the hand has little to do, except to move levers, press electric buttons, open and close throttles, and the like. The ship is a mighty labor-saving machine, which, when the right valve is touched or lever moved, does all the rest. The ship is steered, her boats hoisted out and in, her interior lighted, and the sea around her as well, her guns loaded, aimed, and fired, her turrets revolved, her ammunition lifted to place, her torpedoes ejected, all by aid of mechanical devices. The captain, no longer standing on his quarter-deck and shouting his orders through speaking-trumpet against the wind, rests snugly—or perhaps not very snugly—in his nest of solid steel, and by touch of finger to an electric button, or call into tube or telephone, sends his orders to the right spot at the right time, without fear of their being swept away by the gale.

The growth of complexity of parts and minute subdivision of duties, the multiplication of mechanical devices, in the battle-ship of recent years is bewilderingly large. Something of the kind showed itself in the Civil War. The Monitor and the New Ironsides began the use of labor-saving appliances, but these early ironclads were phenomenally crude as compared with the floating machine-shop and electrical laboratory which to-day bears the name of a ship of war. While the duty and training of the sailor of the past resembled those of the old-time artisan who could do everything in his trade with some measure of ability, those of the seaman of to-day are like the training of

the modern artisan, who is taught to make a single part of a watch or machine, but is expected to do that with the perfection of skill.

CHAPTER III.

THE NEW AMERICAN MONITORS.

As was said in a preceding chapter, for twenty years after the end of the Civil War the United States did nothing towards the development of a navy on the new lines, watching with much interest the work of the naval architects of Europe, but making no endeavor to emulate them. This might at first sight appear too strong a statement, since a number of new monitors, of superior character to those built during the war, were ordered in 1874. But little was done beyond laying the keels and slowly building up the shells of these vessels, an order for their completion being delayed until 1885, while most of them were not completed and put into commission until 1896.

Meanwhile, vessels of the monitor type were being constructed abroad. We have described several of those built in British yards, and might name a number of others, including the single-turreted Glatton and several provided with two turrets. The Russian Government was strongly impressed with the naval events of our Civil War, and in 1863 ordered the building of ten monitors, which were constructed in the Baltic. In 1870 two others of remarkable character were built

for the waters of the Black Sea, and named the Novgorod and the Admiral Popoff. These strange vessels were nearly circular in form, the largest being one hundred and twenty feet long by ninety-six feet wide, their bottoms being flat and drawing fourteen feet of water. A central circular barbette carried two 40-ton guns. These were rather floating forts than ships, their utmost speed being six knots, while they proved very difficult to steer, showing an awkward tendency to revolve like a saucer in the water. As ships they were useless, and their value as floating forts was not tested in the war with Turkey. We mention them here simply as curious and largely useless conceptions of an unpractical naval official.

The American monitors ordered in 1874 were five in number,—the Amphitrite, the Miantonomoh, the Monadnock, the Terror, and the Puritan,—each provided with two turrets and in other respects presenting marked improvements over the single-turreted monitors of the Civil War. They succeeded, as has already been stated, earlier ones of the same names. Of these, the four first named are sister ships, and a description of one will answer for all. The Puritan is a considerably larger vessel and more heavily armed than the others. Our existing navy contains still another monitor, the Monterey, built in 1889–92 by the Union Iron-Works of San Francisco, and, in common with the Monadnock, also built in California, forming part of our Pacific fleet. The others were built on the Delaware, one at Wilmington, two at Chester, and one at Philadelphia.

The AMPHITRITE, built at Wilmington, Delaware, is a double-hulled vessel, like all recent ships of war,

the double bottom of iron coming up to within three feet of the water-line, where it forms a shelf for the support of the belt of armor. This is of steel and extends from stem to stern of the vessel, its thickness being nine inches amidship, from which it tapers to five inches at the ends. The armor-belt is seven feet in width, reaching to a depth of three feet below the water and upward to the main deck, which stands four feet above the water-line. The deck is of $1\frac{3}{4}$-inch steel, overlaid with wood. The delay in finishing this and its sister vessels has proved to their advantage, in enabling them to be completed in the most approved manner and with the advantage of all recent improvements in guns and armor. Thus the two turrets and the barbettes from which they rise are plated with Harveyized steel, which is eleven and one-half inches in thickness on the barbettes and seven and one-half on the turrets, the latter having roofs of $1\frac{1}{2}$-inch steel.

The technical terms here employed call for some explanation. In recent ships the gun-bearing turrets do not rise from the lower deck, as in the old monitors, but descend into circular shields of steel, to which has been given the French title of barbette, already described, and which protect the lower section of the turrets and contain the apparatus for their revolution. The arrangement may be likened to a cylindrical box with a closed top descending into a somewhat larger open cylinder. In other words, the barbette differs from the turret in being open at the top, so that the gun may be lifted above it, while it may form a complete circle, as in this case, or a shield open in the rear, like the barbettes of French and British ships already spoken of. Harveyized steel will be described

in a later chapter, and it must suffice here to say that it is a surface-hardened steel of great resisting powers.

The Amphitrite, in common with her sister ships, has a length on the water-line of two hundred and fifty-nine feet six inches, a breadth of beam of fifty-five feet six inches, and a depth of fourteen feet six inches, her main deck standing four feet out of the water, or about twice the height of that of the older monitors. She was fitted, when originally laid down, with twin-screw engines of 1600 horse-power, and these still drive her, their varied and intricate parts being very ingeniously stowed away in the narrow space below the protective deck. These engines are capable of giving the vessel a speed of 10.5 knots. The coal bunkers have capacity for a maximum supply of two hundred and fifty tons, and the displacement, under full load, is 3990 tons.

Just abaft the forward turret stands the conning-tower, a structure of 9-inch Harveyized steel, whose purpose needs some explanation. The conning-tower may be said to form the brain of all modern war-ships. It is the post of the captain during a battle, and is arranged to give him a broad outlook over the surrounding waters, while affording him protection from danger and enabling him to control every operation of the ship. Speaking-tubes, electric wires, and other devices connect him directly with the helmsman, the engineers, and the crews of the great guns, and he can, without stirring from his steel cell, direct the movements of the rudder, engines, and guns, and, if he wishes, can fire the guns himself, by the mere pressure of an electric button.

The field of sight of the captain is obtained by aid

of narrow horizontal slits through the thick steel of the tower, at the level of the eye. These enable him to follow the movements of hostile ships and give prompt orders to officers and others in every section of the floating fort beneath him. As the body of man moves in quick response to every order coming from the brain, so does the great mass of wood and iron turn and vibrate or send its mighty missiles of war over miles of sea in instant response to the thinking brain within that central cell of steel.

The position of the captain is far from a safe and is by no means an agreeable one. He stands in battle in the centre of a terrible uproar, that of the shells of the enemy bursting around him, the deafening roar of his own heavy cannon, the incessant din of the quick-firing guns, the rushing noise of the force blast under the engines, and various other ear-disturbing sounds which only a man of exceptional self-control could withstand. And his lurking-place is apt to be made the goal of a direct attack by the enemy, when to the noises named are likely to be added those of shells and balls striking the tower with terrible force and with a crash seemingly sufficient to destroy not only the hearing but the brain itself of the bombarded victim within. As some witty writer says, the safest place for the captain would seem to be, not within, but behind the conning-tower.

As an illustration of the peril of the captain's position, we may return to the original conning-tower, the pilot-house of the Monitor, which stood in front of the turret and was occupied during the battle with the Merrimac by Captain Worden and the pilot. The eye-holes in this instance consisted of narrow slits be-

tween the iron logs of which the enclosure was built. Near the close of the battle the gunners of the Merrimac were directed to concentrate their fire upon this structure, and a shell, fired at the short range of ten yards, struck the iron cell and burst against the slot through which Captain Worden was gazing. In an instant he was flung bleeding and blinded across the narrow space, cement being torn from the inner side of the wall and hurled into his face and eyes. He was a ghastly object when picked up, and spent months subsequently in the hospital. Fortunately, he did not lose his sight, and recovered to take a later part in the war.

The fighting capacity of the Amphitrite is by no means small. Each of the turrets contains a pair of 10-inch breech-loading rifled guns, whose power of penetration is very much greater than that of the 11-inch smooth-bores of the first Monitor, or of the 15-inch guns of her successors. Each of these guns weighs twenty-five tons and is capable of driving from its muzzle a 500-pound shell at a velocity of two thousand feet per second. The huge guns of the Monitor proved incapable of penetrating the 4½-inch iron sides of the Merrimac when nearly touching, but the 10-inch rifles of the Amphitrite could send their balls at that distance through more than a foot of steel, and are calculated to penetrate fifteen inches of iron armor on vessel or fort more than a mile away.

In addition to the turret guns the Amphitrite carries upon her decks two 4-inch rapid-fire guns and a secondary battery of two 6- and two 3-pounder rapid-fire guns, two 1-pounder Gatlings, and two Hotchkiss revolving cannon, an armament capable of pouring

from its iron mouths a frightful rain of bullets upon any hostile craft. The 4-inch guns belong to the most effective class of modern marine ordnance. They stand upon a steel pedestal which is firmly bolted to the deck. Upon this the gun-carriage rotates on a circle of rollers, and can be easily elevated, depressed, and directed through a considerable width of range. In front of the gun is a semicircular shield of 2-inch steel, which moves with it and protects its crew and revolving apparatus.

Between the turrets of this vessel stands the military mast, and an upper deck on which are carried the 4-inch and some of the other guns just described. The fighting-top of the mast constitutes an armored platform on which are stationed some of the smaller guns.

Of the other monitors named the MONADNOCK is similar in size, armor, and armament to the Amphitrite, but is superior in motive power and speed, her engines, of the triple expansion type, yielding 3000 horse-power and her speed being twelve knots.

The TERROR was built at the ship-yard of the Cramps at Philadelphia, the keel being laid in 1874 and the completed ship put in commission in 1896. She differs from the two monitors described in having no barbettes, the turrets rising through and projecting above the main deck, as in the original Monitor. This boat is of the same dimensions and displacement as the Amphitrite and of the same horse-power, speed, and coal capacity. She differs, however, in armor and armament, her side armor being but seven inches in thickness. The turrets are plated with 11½-inch armor. Her main armament consists of four 10-inch

breech-loading rifles, two in each turret, the 4-inch rapid-fire guns of the Amphitrite and Monadnock being omitted. Her secondary battery is nearly the same as that of the Amphitrite, consisting of two each of 6-pounder, 3-pounder, and 1-pounder rapid-fire guns, two Hotchkiss revolving cannon, and two Gatlings.

The leading feature of interest in the Terror is the lately introduced compressed-air system for steering the ship and loading and handling her guns, an innovation which has been received with much commendation. Steam-power and hydraulic power had previously been employed for these purposes, but the new agent appears to have elements of superiority over both its competitors. One of its main advantages has to do with ventilation. Steam and hydraulic engines exhaust outwardly, by means of pipes passing through the hull of the ship, but the pneumatic or compressed-air engine may be made to exhaust either into the outer air or into the ship. The flow of air from the exhaust pipes of a pneumatic engine would be of the greatest service as a means of ventilation in some confined portions of a ship's interior, as in the close and contracted steering-room, situated far aft below the protective deck, or in the interior of the turret, with its heat-yielding machinery and its crowd of men during a battle. Localities which would be uncomfortably hot if provided with steam piping, and also exposed to danger from the possibility of a steam-pipe breaking during action, could with pneumatic power avoid these difficulties and be supplied with air of reduced and even temperature. The greater clean-ness and convenience of the pneumatic system are

other points in its favor, the discomfort arising from the frequent leaking of the cylinders and pipes of the hydraulic system being avoided.

In the Terror the compressed air is employed in the diverse duties of revolving the turrets, elevating or depressing the guns, lifting the ammunition into the hoisting cages, raising these to the breech of the gun, ramming home the charge, closing the breech, taking up the recoil on firing, and steering the ship. Two separate steam-engines serve to compress the air which is required for these various purposes.

For the turning of the turret two pneumatic engines are provided, they being placed on the floor of the turret, one on each side of its big guns, and turning with it as it revolves on its circle of wheels. These engines are easily controlled by the officer who occupies the sighting-hood rising above the roof of the turret, there being levers and hand-wheels by whose aid he can turn the great iron cage and direct the guns towards any point he may desire.

Hinged to the floor of the turret is a massive ram, which bears against a shoe on the under side of the gun-carriage, its purpose being to elevate or depress the gun. When the gun is to be elevated a mixture of glycerin and water is forced by compressed air from an adjacent cylinder into the ram, which is forced vigorously upward. The reverse operation serves for depression. Valves regulate the supply, and these are under the control of the officer in the sighting-hood, who is thus enabled by the movement of his hand to elevate and train the gun as he will.

The sighting telescope by which the conning officer fixes the position of the distant target is connected with

each gun by a system of levers so that the axes of glass and gun are always kept parallel. With his eye at the telescope and his hand upon the levers which control all the apparatus below, this officer needs but to bring the cross hairs on the object-glass of the telescope to cover the target, when, by a slight pressure of an electric button, he can hurl a 500-pound shell from the muzzle of the great cannon with the nicest precision upon the distant mark.

The recoil of the gun is easily controlled by the same system of compressed air. Beside it are two pneumatic cylinders, within which act pistons attached to the gun, and held in position by an air-pressure of about five hundred pounds to the square inch. As the piston is driven back into the cylinder by the recoil of the gun, the air, compressed into a smaller space, rapidly increases in pressure. Too great pressure is prevented by an arrangement for letting a portion of the air escape through the piston to the opposite side, while sufficient pressure remains at the end of the recoil to force the gun back to its place. The elasticity of the air prevents all shock, it forming an easy cushion both for the recoil and the return movement of the gun.

These are not the only services performed by the useful air engines. That alluded to of lifting the ammunition and loading the gun is of sufficient interest and importance to be described. Immediately below the tunnel lies a room of great importance in the economy of the ship, the handling room, in which during an engagement a crew is kept actively engaged in supplying food for the rapacious engines of destruction above. Adjoining this room, and opening

into it by water-tight doors, are the magazine and shell-rooms, the doors of which are usually kept tightly closed.

In the centre of the landing-room is a pneumatic loading machine, which rotates upon a vertical shaft and can be swung to right or left for the reception of the load. This consists of the 500-pound shell and the cartridge, the latter being made up in two sections. These are brought from their respective rooms on an overhead trolley, placed successively in the loading machine, and transferred from this to the pockets of the loading car. There are three of these pockets, one for the reception of each of the three portions of the charge. The car is now lifted into the turret, and is brought to a stop with the shell directly opposite the open breech of the gun.

All these movements are performed readily and quickly by aid of compressed air, and the same useful servant completes the work, driving the shell into the gun by the thrust of a pneumatic rammer, and after it the two sections of the cartridge, the cage being rotated to bring each of them into position. The breech-plug is then swung into place, thrust into the open breech, and firmly locked. All these operations are performed quickly and almost automatically, and shell after shell can be discharged with rapidity from each of the two great guns.

The steering is the final operation performed by the pneumatic apparatus, and may be briefly described. The tiller by which the rudder is moved rests between two long cylinders whose pistons are connected by a common rod, in whose centre is a hollow cross-head in which the tiller has free room to slide. Compressed

air is admitted to one cylinder and exhausted from the other, driving the pistons and the rod forward or backward as the helm is to be shifted to port or to starboard. When the tiller is at rest, air lies behind each piston, and forms a useful elastic cushion to take up the shocks of the tiller as it is violently moved in rough weather, and save the framework of the ship from the strain of these shocks.

The MIANTONOMOH, the fourth of the original double-turreted monitors, closely resembles the Terror in many particulars, being identical with her in dimensions, tonnage, and speed, but having a somewhat smaller motive power, the indicated horse-power of her engines being 1426. Her armament consists of four 10-inch breech-loading rifles in the main battery, and in the secondary battery of two each of 6-pounder, 3-pounder, and 1-pounder rapid-fire guns.

The keel of this boat was laid in the ship-yard of John Roach & Sons, at Chester, on the Delaware River, in 1874, but she was not finished until 1897, at League Island Navy-Yard. In many respects she repeats the old monitor Miantonomoh, of the Civil War period. Her side armor is seven inches in thickness and extends through a width of six feet. The deck armor, of 1¾-inch steel, is divided into two plates, placed one above the other, the whole being planked over with four inches of pine flooring. The turrets, which are twenty-four feet in external diameter, and rise somewhat more than six feet above the deck, are plated with 11½-inch compound armor (iron and steel), behind which are ten inches of wood backing, and internally two thicknesses of steel plate, each one-half inch thick. The conning-tower surmounting the

turret is nearly eight feet in diameter and two feet in height, and is armored with 9-inch steel.

In describing the turret, a source of peril to the crew needs to be mentioned. The striking of the turret by a ball from a hostile ship is apt to cause the heads of the rivets to fly off and be hurled forcibly across the confined space. In order to prevent the firing crew from being bombarded with missiles of this kind, the turret is lined by an inner shield of ¾-inch steel plate, which stands eight inches within the walls.

In the Miantonomoh hydraulic power is used, instead of the pneumatic system of the Terror. The processes of loading are similar to those already described, while the recoil of the gun is taken up by an hydraulic cylinder, in which the water escapes from behind the piston in limited quantity, so as to bring the gun to rest without serious shock. After firing, the turret is rotated by the conning officer, so as to present a solid front to the fire of a hostile ship while the guns are being reloaded. This operation performed, a touch brings them back to the firing position. The turret turns on steel rollers, twenty in number, linked together in a circle, while above them a double line of teeth encircles its base, in which the cogs of the wheels of the turning engine engage. A diaphragm of leather around the turret prevents the entrance of water.

The PURITAN, like the monitor just described, was begun in 1874 in the Roach ship-yard at Chester, and was finished in 1896 at the Brooklyn Navy-Yard. This vessel is considerably larger than those named, being two hundred and eighty-nine feet six inches long,

DOUBLE-TURRETED MONITOR PURITAN.

slightly over sixty feet wide, and eighteen feet in mean draught, with a displacement of 6060 tons. She has an indicated horse-power of 3700 and a speed of 12.4 knots per hour. Like the Monadnock, she is fitted with a twin-screw, horizontal, triple-expansion engine, and can carry a coal-supply of four hundred tons.

The belt of armor of this ship tapers from fourteen inches amidships to ten inches at the bow and six inches at the stern. Her turrets are barbetted, the barbettes being plated with fourteen inches of steel armor and the turrets with eight inches. Her protective deck is plated with two inches of steel armor. Her main armament surpasses that of any of her fellow-vessels, being composed of four 12-inch breech-loading rifles, and six 4-inch rapid-fire guns. Her secondary armament includes six 6-pounder and two 1-pounder rapid-fire guns and two Hotchkiss revolving cannon.

The MONTEREY, the last monitor built by the United States government, was of later construction than those above named, being ordered in 1887, at the time it was decided to complete those already on the stocks. The keel of this vessel was laid in 1889 at the Union Iron-Works, San Francisco, and it was put in commission February 13, 1893. Its late date of building enabled it to be constructed with all the recent improvements in naval architecture, and as a coast-defence vessel it is among the most powerful of the new navy.

The Monterey differs little in dimensions from those described, it being two hundred and fifty-six feet in length, fifty-nine feet in breadth, and fourteen feet ten inches in draught, with a tonnage displacement of 4084.

In engine-power and speed, however, it surpasses them all, it being moved by twin-screw, vertical, triple-expansion engines of 5244 horse-power, while its speed is 13.6 knots per hour. Its coal-carrying capacity is low, being but two hundred tons. This boat is constructed entirely of steel, and is much more heavily armored than the other monitors, with the exception of the Puritan, the armor belt being composed of thirteen inches of steel amidships, which tapers to eight inches at the bow and six inches at the stern. To the protection afforded by this is added that of a double bottom and water-tight bulkheads, there being no less than one hundred and ten separate compartments within the vessel, each secure against the inflow of water.

Low barbettes protect the turning-gear and other apparatus of the two turrets, the forward barbette being protected by thirteen inches, the aft by eleven and one-half inches of steel armor. The turrets rising from these are armored, the forward with eight inches, the aft with seven and one-half inches of steel. The Monterey was built with the idea of doing her principal fighting head on, and is more strongly protected in front accordingly. The turrets are armed in view of the same contingency, the forward one carrying two 12-inch, and the rear one two 10-inch breech-loading rifled cannon. Her secondary battery is composed of six 6-pounder and four 1-pounder rapid-fire and two Gatling guns, part of this secondary armament being carried on the deck of the superstructure between the turrets and part on the fighting-top of the military mast.

The other monitors named are fitted with horizontal

or inclined engines, the limited space provided for them demanding great economy of area in placing these complicated pieces of machinery. The powerful engines of the Monterey, however, are vertical, their three cylinders being respectively of twenty-seven, forty-one, and sixty-four inches diameter and thirty inches stroke. They are supported by cast-steel inverted Y frames securely bolted to cast-steel bed-plates, and, in common with the other machinery, have been made as light as possible. To attain this end coil boilers are used for the greater part of the power. There are two cylindrical boilers capable of propelling the vessel at ten knots speed, and which are used for ordinary purposes, the coil boilers being reserved for emergency cases, and enabling sufficient steam to be made in less than half an hour to give the vessel her maximum speed.

The Civil War monitors were suited to coast defence only, the fate of the first vessel of this type showing their lack of sea-going powers. This is not fully the case with the double-turreted monitors described, which, but for their low freeboard, bear a general outward resemblance to the battle-ships, their central superstructure and military mast giving them a more formidable appearance than the low-lying craft of Ericsson's original design. Some of these, while still best adapted for harbor defence and coast duties, are at present on the open seas with the war-fleets, and the Monterey has been sent across the broad stretch of the Pacific to take part in the defence of Manila Bay.

The monitor design, as worked out by Ericsson, has many points of superiority to the low freeboard

turret-ships of the British navy built after the design of Captain Coles. The latter rise higher out of the water and their turrets are sunk in great part below the deck, while in the former the turrets stand to their full height above the upper deck. An important feature of superiority in the American monitor is its complete system of artificial ventilation, which permits all the orifices of the deck to be hermetically sealed except those that admit the air. These are high shot-proof trunks, which exclude the water while admitting the air.

This system of ventilation has the advantage over that depending on open hatches or gratings that it permits the sides of the vessel to be made very low, and therefore renders a greater thickness of armor admissible. The larger part of the extra weight, however, is usually expended upon the turret and guns, the low sides presenting a mark difficult to hit, while their overhanging construction protects the lower hull.

Ventilation is provided for by fans, which suck the air in through the shot-proof trunks or tubes, made inaccessible to spray or rain. After traversing every part of the ship, the air is discharged into the furnaces, and finally escapes by the chimney, the lower portion of which is made shot-proof. The cabins are lighted from the deck by bull's-eyes, shutters being provided to cover these lights when the vessel is in action, in which event artificial light is used. Of course, the close confinement of the crew of a monitor is restricted to times of action or storm, they being able to use the deck under ordinary circumstances.

Belief in the utility of monitors for certain exigencies of warfare seems indicated by the fact that

the thirteen monitors remaining from the Civil War, and which for many years had lain useless and decaying in the waters of League Island, were rapidly repaired and brought into service again in the war times of 1898, being stationed for coast defence at various exposed points along the coast. The decay had been superficial only; their engines and other important parts had been kept in order, and little change was necessary to bring these veterans of 1862 again into working order.

In the Naval Appropriation Bill of 1898 four other single-turreted monitors, of small size and eleven feet draught, were provided for. These are to sit low in the water, having a 20-inch freeboard, while their light draught will enable them to navigate shallow waters and avoid more powerful antagonists. Their speed will be the same as that of the Puritan, and while they will have only half as many large guns, their secondary batteries will be fully up to date and make them nearly as powerful as the Terror and the others of her class. Unlike the original monitors, these will have a superstructure deck and a military mast, on which will be placed several 4-inch rapid-fire guns and a numerous battery of 6- and 1-pounders and machine-guns, while the turrets will carry two of the latest pattern 10-inch breech-loading rifled guns.

CHAPTER IV.

BATTLE-SHIPS OF THE UNITED STATES.

In old-time naval warfare we read much of two classes of war-vessels, the heavy and somewhat slow two- or three-decker line-of-battle ship and the single-decked and swift frigate that acted as an ocean scout for the more dignified squadron which would bear the brunt of battle. The place of these two is taken to-day by the battle-ship and the cruiser, the former slower and more cumbrous, yet far more powerful, the latter able to scour the seas, ready to fight with one of her own kind, yet free to fly without disgrace from the great guns of the heavier ship, whose armor she cannot hope to pierce or whose mighty projectiles to endure. Up to 1898 the annals of war contain but one record of a contest between cruisers and battle-ships, the battle of the Yalu, between the Japanese and Chinese fleets. Here a squadron of swift Japanese cruisers for several hours circled round two somewhat antiquated battle-ships, the Ting Yuen and Chen Yuen of the Chinese fleet, pouring in a hail of fire from their rapid-fire guns, varied with an occasional shell from their great 66-ton cannon, yet the battle-ships came out of the fight little the worse for the battering they had received, though it was sufficient to have sent to the bottom a fleet of ordinary cruisers. Had these two ships been better manned the result of that first battle between modern ships might have

been very different. As it was, it proved conclusively the great resisting power of the modern battle-ship.

A modern battle-ship is singularly unlike the great liner of the past, and a far more cumbrous and intricate piece of floating machinery. The former could be manned by ordinary seamen; the latter is like a great workshop filled with skilled mechanics. A recent writer has compared the battle-ship to a monstrous honey-comb, made up of multitudinous separate cells or compartments, and supplied with machinery every piece of which needs skill and intelligence for its proper handling. The engines, the guns and turrets, the lifting and loading apparatus, the range-finder, and the various other mechanisms can be managed only by men of long experience, and in the manning of such a vessel the sailor gives way to the artisan. There is no pulling of ropes or spreading of sails to the breeze, no clambering aloft on swaying shrouds or reefing canvas in the face of a gale, no dancing on a yard-arm to the whistling of the wind; but far below a throng of sooty coal-heavers is kept busy hurling fuel into flaming furnaces, while sweating engineers watch the steam-gauge with careful eyes, and out of sight in the rear a swift revolving screw takes the place of the discarded sail in driving the ship through the ocean waves.

A like radical change has come over the armament of the ship of war. Instead of long rows of frowning port-holes, in several successive ranks, with black muzzles protruding and flames belching from the whole side of the ship in times of battle, we see now a brace or two of mighty guns looking grimly out frcm the sides of revolving turrets, with smaller ones peer-

ing through casements or from behind shields of steel, some of them from far up the mast, whose modern mission seems to be to bear guns instead of sails.

In short, an extraordinary metamorphosis has taken place, the ship of the present is an utterly different piece of mechanism from that of the past, and the captain of a Roman galley would have gazed with less surprise upon a past century ship of the line than would Lord Nelson upon the battle-ship of the present day. What a battle-ship is and of what parts it is composed have been already generally indicated in a former chapter. It is our purpose now to describe specifically those of the United States, mentioning them in order, as they came successively into being.

The smallest of our battle-ships, and the first to be put in commission, is the Texas, whose building was authorized August 3, 1886, and her keel laid June 1, 1889. She was launched June 28, 1892, but was not commissioned until three years later, August 15, 1895. The first efforts towards the building of a new navy in this country had been confined to monitors and small cruisers, and when at length a battle-ship was ordered, it was of far smaller dimensions than many of those then existing abroad. The Navy Department was slowly feeling its way to bolder ideas.

The TEXAS was built at the United States Navy-Yard, Norfolk, Virginia, on plans originally furnished by English designers, but much altered during the progress of construction. Her displacement is 6315 tons, and she is driven by two sets of triple-expansion engines, capable of developing 5800 horse-power with natural draught, which with forced draught can be

increased to 8610 horse-power. She is fitted with twin-screw propellers. The length of this vessel on the water-line is three hundred and one feet four inches, her breadth sixty-four feet one inch, and her mean draught twenty-two feet six inches. She is capable of carrying eight hundred and fifty tons of coal, and attained a trial-trip speed of 17.8 knots per hour.

The Texas is armored with twelve inches of steel plate through one hundred and sixteen feet of her length, the belt of armor extending two feet above the water-line and four and a half below it. She possesses a protective deck of 2-inch steel, and carries two turrets plated with 12-inch steel. Like all the later battle-ships, she is built on the cellular plan, a double bottom extending below her engines, boilers, and magazines, and being divided into numerous compartments. In all, the ship has one hundred and twenty-nine of these compartments, connected to steam- and hand-pumps by a drainage system embracing the whole vessel. She is lighted throughout by electricity.

The main battery of the Texas consists of two 12-inch breech-loading rifles, each weighing forty-six and a half tons, mounted in two turrets, one on either side of the forward deck; and six 6-inch breech-loaders, protected by steel screens. Her secondary battery embraces seven 6-pounder and eight 1-pounder rapid-fire guns, with four 37-millimetre Hotchkiss revolving cannon and two Gatlings. Those are partly mounted on the gun-deck, behind a 1½-inch steel plating, partly on the bridge and the military tops of the masts. In addition she possesses, in common with all the other battle-ships, an armament of torpedo-tubes, two in

number. The arrangement and use of these tubes will be described in connection with some of the later ships.

Next on our naval list comes a ship of whose disastrous history we have already spoken, the ill-fated Maine. This famous vessel was built to occupy a position at that time not represented in our navy, that of the armored cruiser, but after completion was ranked by the department as a second-class battleship. As such, therefore, we must here consider it.

The MAINE was authorized at the same date as the Texas, August 3, 1886, was launched November 18, 1890, and put in commission September 17, 1895. Her limit of cost, like that of the Texas, was fixed at $2,500,000. She was built by the government at the Brooklyn Navy-Yard, her keel being laid October 17, 1888. The Maine was a twin-screw steel vessel, with a length on load-line of three hundred and eighteen feet and a breadth of fifty-seven feet, her mean draught being twenty-one feet six inches, and displacement 6682 tons, somewhat less than that of the Texas. Her engines were of the vertical, triple-expansion type, their maximum development of horse-power being 9293 and her record of speed 17.45 knots. Her coal-carrying capacity was sufficient for a journey of seven thousand knots.

The rig of the Maine, like that of the Texas, comprised two military masts. She was protected for a length of one hundred and eighty feet by side armor of 12-inch steel. Her turrets differed in position from those of the Texas, standing diagonally amidships, and were plated with 8-inch steel, the barbettes from which they rose being protected by 12-inch steel

THE MAINE.

armor. The deck plating was two inches in thickness, increasing to four inches on its sloping sides. The bow was sheered into a formidable ram. She was the first of our ships to be provided with cocoa-fibre for protection against water, having a lining of this material covering four thousand seven hundred and thirty-seven cubic feet.

The turrets were placed, one forward on the starboard beam, the other aft on the port beam. In order to afford the fullest effect to her guns under this arrangement, the intervening or superstructure deck was cut away so as to give full play to the four great guns, allowing their fire to be concentrated ahead or astern, or on either beam, at will.

The turrets of the Maine carried each two 10-inch breech-loading rifles, her main battery also including six 6-inch rapid-fire rifles protected by shields of 2-inch steel, and so arranged that three of them could be trained at once on any given spot. In addition she carried seven 6-pounder and eight 1-pounder rapid-fire guns, four Gatlings, and four Whitehead torpedo-tubes. Her high speed and ready handling, in connection with her complement of four guns of large caliber, whose fire could be concentrated on any spot, made the Maine a very effective ship, and her destruction was a serious loss to our navy.

Unfortunately, she was assailed at the weak point of all modern war-ships, her unprotected bottom, and with an explosive of such immense force that her system of compartments proved useless for protection, the vessel being virtually broken in two and her bottom forced upward until portions of it stood above the normal position of the deck. In all the history of tor-

pedo warfare there is no other instance of such complete destruction as that shown in the case of the Maine. What part torpedoes may play in future wars remains to be shown; large provision has been made for their use, but equally large provision for defence against them, and it is an open question what will be the final result of the employment of this new and threatening arm. As for their terribly destructive powers, when employed from without, the Maine bears witness, and every modern battle-ship is in daily danger of being blown into fragments from the perilous explosives which she carries within her hold.

It was not until 1890 that the United States fully accepted the situation, and prepared to build battle-ships that would compare with the best of those in existence. On June 30 of that year an act of Congress was passed authorizing the construction of three first-class ships of this character. The completion of these, technically known as coast-defence battle-ships, yet fully competent to venture upon the open seas, first put this country on a level with foreign nations in the matter of naval construction, and in some respects in the lead. These vessels (the Indiana, Massachusetts, and Oregon), with their 10,288 tons of displacement, did not, it is true, equal in size the greatest ships of the British navy, such as the Royal Sovereign, of 14,150 tons, and the Prince George, of 14,900; but any superiority in size was offset by the greater weight and more effective disposition of the armament of the American ships, and in warfare the latter would certainly prove well able to hold their own with any ships in the navies of the world.

The three vessels named are sister ships, and a de-

scription of one will in a measure serve for all, though they differ in minor particulars. They are of equal dimensions, being three hundred and forty-eight feet long, sixty-nine feet three inches wide, and having a mean draught of twenty-four feet, their maximum draught when fully loaded with coal being twenty-seven feet. Their tonnage displacement is 10,288, and normal coal supply four hundred tons, though they have a bunker capacity for nearly sixteen hundred tons. They are fitted with twin-screw, vertical, triple-expansion engines, and resemble each other in armor and armament, though differing somewhat in speed. We shall therefore speak particularly of the Oregon, in view of the fact that, while classed as a defender of our coast cities and maritime border, this vessel has effectually proved her sea-going powers by steaming from San Francisco to the North Atlantic coast, a distance of some thirteen thousand miles.

The Oregon, built at the Union Iron-Works, San Francisco, had her keel laid November 19, 1891, was launched exactly two years afterwards, and was commissioned July 15, 1896, having shown a speed on her trial trip of 16.79 knots. She, in common with her sister ships, the Indiana and the Massachusetts, carries a side armor of Harveyized steel, eighteen inches thick in its upper half and bevelled below down to eight inches at the bottom. It has a width of seven feet two inches, resting on the double skin of the lower hull, and rising three feet above the water-line. This armor-belt extends two-thirds the length of the ship, and is joined at its ends by bulkheads or transverse walls of 14-inch steel, the whole forming a practically impregnable central citadel for the protection of the

vital parts of the ship,—the engines, boilers, and magazines. The top of this great steel box is covered by a roof of $2\frac{3}{4}$-inch steel, the whole enclosure being impervious to any projectile likely to be hurled against it. Forward and aft of the citadel the steel deck extends, of the same thickness, in a gradual curve to the bow and stern.

This roof of steel is known as the berth-deck. Above it and the citadel the sides of the ship rise about eight feet, at which height extends the main deck. The sides of the ship above the 18-inch belt are protected by a belt of 4-inch steel, back of which, in the bunkers, lie some ten feet of coal, the whole being sufficient to keep out rapid-fire shells, or even the shells from the great guns if of long range or if they strike it in an oblique direction. Fore and aft of the citadel this upper section of the ship has no armor except that of the berth-deck, she being quite able to swim and perform her evolutions if all this part were shot away. The hull thus denuded would still possess the floating power of a double-turreted monitor.

Looking aft from the bow of the vessel, or forward from the stern, one would see its main agents of destruction, the threatening mouths of two great cannon, with yawning openings of thirteen inches in width, their smooth black length showing for twenty-three feet beyond the walls of the turret with which they revolve, and in which the loading and firing apparatus is concealed. The turret consists of a solid wall of steel, circular in shape and fifteen inches in thickness, its lower edge being surrounded by the top edge of another circular steel wall seventeen inches thick, known as the barbette. This descends to the

level of the 18-inch armor-belt below. There thus extends a wall of steel from fifteen to eighteen inches thick from the top of the turret to a depth of four and a half feet below the water-line of the ship, completely protecting from any ordinary attack the crew of the guns, the loading apparatus, the powder and shell, and all the important mechanisms within. The circular track upon which the turret revolves stands just below the top of the barbette wall, and at once enables the gunners to direct their pieces towards any point in the horizon, or to turn them away, when loading, from the line of an enemy's fire, so as to prevent missiles from entering the port-holes through which the great guns protrude. The gun turrets are somewhat difficult objects to hit in the excitement of action. In the battle of the Yalu not a fourth of the shells hurled at the Chinese battle-ships hit their mark. And of those that reach the turret, the great majority are apt to glance harmlessly away from its rounded sides. In short, hardly one shot in thirty that strike is likely to make a direct hit and pierce this solid mass of steel. On the turret's top, just lifting above its level, and practically safe from harm, stands the sighting-hood, through whose two horizontal and two vertical slots the captain of the gun-crew can watch the enemy and direct the movement of the guns, or can himself, by the aid of convenient levers, train and fire them.

The forward and aft turrets are not the only ones possessed by the Oregon. In fact, this and its sister ships are abundantly provided with this important adjunct, they having four other turrets of smaller size. These stand between the main turrets, ranged in pairs, two on each side of the ship. From the port-holes of

each of these protrude two 8-inch rifled guns, protected by the 6-inch steel armor of the turret walls and the 8-inch armor of the barbettes below.

The 8-inch guns are lifted to a height of twenty-six feet above the water-line, this enabling them to fire over the tops of the main turrets, so that they may be aimed dead forward or aft, while their height permits them to be worked with effect in any weather. In addition to the guns named there are four others, of 6-inch aperture, which stand upon the main deck near the smaller turrets, under the protection of shields of 6-inch steel. These are so placed that they all can deliver broadside fire, while one pair can fire direct ahead and the other direct astern. These formidable floating ports, therefore, have in all a main battery of four 13-inch, eight 8-inch, and four 6-inch breech-loading rifled cannon, half of which can fire together dead ahead and half dead astern, while all the 13-inch guns and half the others can deliver together a broadside fire.

This is not their complete armament. There is a powerful secondary battery, consisting of twenty 6-pounder and six 1-pounder rapid-fire guns and four Gatlings, variously placed for effective work on the superstructure and the military mast. The ship carries in addition two field-guns, intended for the use of landing parties, and three Whitehead torpedo-tubes, situated in the lower region below deck.

The conning-tower, which is plated with eight inches of steel, stands back of the forward main turret, and forms the base of the military mast. Its elevation is such as to give a clear view through its series of narrow slits around the whole circle of the horizon,

and enables the commander to perceive at any point the position of hostile ships or batteries. He has a ready command of an elaborate system of telephones, speaking-tubes, and electric calls, enabling him to communicate with all parts of the ship and give his orders to gunners, engineers, helmsmen, and others without moving from his station. He can, at will, lay his hand on any part of the ship, from the steering-room to the turrets, turn her to right or left, send her fast or slow, aim her guns, and concentrate her mighty batteries upon any weak spot in the enemy's line.

Above the conning-tower stands the pilot-house, from which the ship is handled except when battle is actually going on. These form the lower section of the military mast, on each side of which, upon the roof of the pilot-house, two search-lights are situated, each of one hundred thousand candle-power. Just above them stands a small platform containing the controlling mechanism, by whose means the light may be raised or lowered and made to sweep with its powerful beam the whole circle of the horizon. These great rotary lights are absolutely essential to the warfare of the present day, as an aid to discover the lurking, swift-moving torpedo-boat, which if permitted to creep up unseen might in a moment send the mightiest battle-ship to the bottom of the sea. When near an enemy at night these lights need to be kept in incessant play, for then death and destruction lurk silent and hidden upon the waters, and only ceaseless vigilance can guard against their covert assaults. The torpedo-boat is the one unceasing dread of the crew of the most massive of modern floating citadels, a small but terrible foe, its approach insidious, its sting

fatal, its errand death. As yet, indeed, the torpedo in warfare has not shown much effectiveness, watchfulness having prevented its assaults, but it is full of frightful possibilities, and vigilance upon a man-of-war is the only assurance of safety from swift destruction.

We may in a few words complete the story of the military mast, that essential feature of the modern ship of war. Extending as a circular tower of steel above the pilot-house, it bears at various heights one or more platforms, each protected by a circular shield of steel, and serving as a fighting-top for the marines. They bear the smaller rapid-fire and machine-guns, and from their elevated height a rain of balls can be poured during an engagement upon the deck of a foe. They serve also as the lookout stations of the ship. From the base of the military mast, and occupying the space between the main turrets, there rises above the main deck what is known as the superstructure deck, upon which a part of the secondary battery is mounted; and also the bridge-deck, upon which are stowed the lifeboats, gigs, and steam-pinnaces. A powerful steam-crane stands on each side of the ship, its reach enabling it to pick up a boat from the water, lift it to a height of thirty-five feet, and place it in position on the bridge-deck.

Descending now to the interior of the ship and walking forward, we reach a section of the ship to which allusion has already been made and of which fuller description is needed, the bow torpedo-room. In modern warfare the use of the torpedo is not confined to the special torpedo-boat, but battle-ships and cruisers are provided with this terrible implement of

warfare, the Indiana having two torpedo-tubes, the Oregon and the Massachusetts three each. Our journey forward will bring us to one of these, a long cylinder whose outer end pierces the bow of the ship, a cover-plate closing its port-hole, when not in use, against the entrance of water. These tubes are inclined slightly downward, in order that the torpedo shall enter the water shortly after leaving the gun and progress under water towards the unprotected part of the hull of a hostile ship. In some instances the tube opens below the water surface, to protect it against the enemy's fire. There is difficulty in both cases. For a torpedo to plunge from the air into the water causes a severe strain to its delicate mechanism. But for an elongated body to be thrust out of a hole into water that may be rushing past at a rate of eighteen knots an hour is equally likely to cause a strain. The latter difficulty, however, has been overcome, and in some foreign ships the torpedoes are arranged to be discharged under water.

Suspended from the ceiling of the torpedo-room are the 18-inch Whitehead torpedoes. Each of these weighs eight hundred and thirty-five pounds, and is divided into three compartments. The first contains the charge of gun-cotton, which is exploded by contact when the torpedo strikes the mark; the second is charged with air at a pressure of thirteen hundred pounds to the square inch; the third contains the little compressed-air engines by which the miniature screw propellers which drive the torpedo through the water are operated. Horizontal rudders enable the torpedo to move through the water at any desired depth.

In the case of firing, the torpedoes are picked up

by a chain hoist, run along overhead tracks, and lowered into the tube at its open breech. This being closed, the torpedo is driven out by compressed air or by a small charge of powder. The act of discharging starts the engine of the torpedo, which has sufficient power to drive it forward in a direct line for four hundred yards at a speed of thirty knots, or eight hundred yards at twenty-seven knots an hour. The tube mentioned provides only for the discharge of a torpedo dead ahead. There is another tube in the stern, and in some ships one on each side, the latter being fitted to the ship by a ball and socket joint, so that they can be trained on an enemy through a considerable range. These formidable weapons are incapable of being utilized except at comparatively short range, and their perilous possibilities are likely to keep battle-ships somewhat far apart in future engagements. Any approach within half a mile might subject a fighting ship to the danger of being blown out of water by a hidden missile of this kind, and the hand to hand fighting of the past is not likely to be indulged in except in extreme cases.

The MASSACHUSETTS, as has been said, is in every respect similar to the Oregon. She was built by the Cramps, of Philadelphia, at a contract cost of $3,020,000. The INDIANA was built by the same firm and at the same price, this being slightly less than the contract price of the Oregon, which was $3,180,000. All these vessels are protected against the entrance of water through shot-holes by a packing of cocoa-fibre, a substance also used in the Iowa, while in all the later battle-ships a packing made from the pith of the corn-stalk is employed, experiment having

shown that this is at once more effective and of lighter weight. While nearly sixteen thousand cubic feet of cocoa packing is required for these vessels, less than eleven thousand cubic feet of the corn-pith material has been deemed sufficient for the Kentucky and the Kearsarge.

A description has already been given of the mode of handling and loading the great guns of these ocean monarchs, but something further in this direction may prove desirable. In the case of the 13-inch guns, each of which weighs sixty-seven tons, this is a matter that calls for very accurate and well-devised mechanism, and labor-saving arrangements have been carried to perfection, a single man being able to raise and lower these massive cylinders of steel and swing them through an arc of 270 degrees. This can be done within the sighting station by the movement of a few levers and hand-wheels. The entire turret with its two great guns can be as easily handled, its revolution being effected by the aid of hydraulic engines situated within the barbette.

The recoil of the guns is another matter of high importance, they being driven back, as the projectile is hurled from their muzzles, with an initial energy of over thirty-six thousand foot-tons. This, as has been already said, is overcome by the aid of a recoil cylinder mounted within the gun-carriage beneath the gun and filled with water, which takes up the motion of the gun, part of the water being forced through a relief valve as the gun recedes. The gun is driven back again to the firing position by hydraulic pressure applied to the piston in the recoil cylinder.

The method of loading and firing these guns has

been already described, but some statement about the breech mechanism will be in place here. In some foreign systems the closing of the breech is performed by a plug, which is driven downward through an opening in the top of the breech; but in the American system the plug is inserted at the rear of the gun and held in place by a screw-thread. A deep and strong thread is cut on the plug and its counterpart in the breech aperture. This thread is then cut away in a number of wide channels,—three in this instance,—alike in plug and breech, the result being that there is presented a series of three sections of thread and an equal number of blank spaces between. In closing the breech, the plug is pushed in with its threaded sections opposite the channels or blank spaces of the breech opening. This done, a one-sixth turn of the screw causes the threads to engage with each other and effectually locks the breech.

In removing the plug for reloading, a one-sixth turn is given it, so as to disengage the threads; it is then drawn out upon its tray, and by a third movement is swung aside upon its hinges. In a more recent method two movements replace these three. The plug is made conical instead of cylindrical, so that, after the threads are freed, a single movement draws it out and swings it aside upon its hinge. There are numerous breech mechanisms in use, some of them being very complicated. The system employed in the vessels in question is greatly simplified over some older designs, all the movements of unlocking and locking the gun being performed by one man with the aid of a crank placed on the side of the gun. The first movement of this crank gives the plug a one-sixth turn

and frees the threads. Other movements draw it out and swing it aside upon its hinge. In restoring it to place a reversal of these movements is all that is needed.

The battle-ships with which we are here concerned are among the most powerful of those now afloat in the navy of any nation. Their structural and armored protection is of the first rank, and they fairly bristle with guns, large and small. There are faster and larger battle-ships, but none that could give as hard blows or show more powers of endurance than these grim dogs of war. Their preponderance lies in the eight 8-inch guns, which occupy the four subordinate turrets. The ordinary type of battle-ship has a main battery of four heavy guns in the fore and aft turrets, with a secondary broadside battery of 5- or 6-inch guns; the former for armor-piercing, the latter for use against the weaker portions of an adversary's hull. To this armament the Oregon and her sister ships add the powerful extra battery of the eight 8-inch guns, each capable of throwing a 250-pound ball or shell with immense force. This preponderance of firing power must prove of great importance in a battle with any hostile ship.

To conclude our description of these battle-ships, it may be said that the Oregon has a maximum of 11,111 horse-power, sufficient to give her 16.79 knots of trial speed. The Massachusetts has 10,403 horse-power and made 16.21 knots, and the Indiana shows 9738 horse-power and attained 15.54 knots of speed. Their engines are of the vertical, triple-expansion type, each enclosed in a water-tight compartment, and are driven by six steel boilers of the horizontal fire-tube

type. They are run at a steam-pressure of one hundred and sixty pounds, and, in addition to supplying steam for the main engines, operate eighty-six other engines, or one hundred and fifty-eight cylinders in all, these auxiliary engines being employed in various duties about the ship. In short, such a ship resembles a great floating workshop filled with intricate machinery, a hive of industry run by mechanics under the title of sailors.

The ships just described have been designated in naval lists, as has been said, coast-defence battle-ships. The IOWA, next to be considered, enjoys the distinction of being a sea-going battle-ship, of first-class dimensions, and is at once the largest and the swiftest of our battle-ships yet in commission. This division into coast-defence and sea-going battle-ships is, however, somewhat misleading. The Iowa bears a general resemblance to the ships above mentioned, and, though the latter were not specifically designated as sea-going, the remarkable performance of the Oregon, in her thirteen-thousand-mile journey from San Francisco around South America to Florida, has proved conclusively the sea-going powers of ships of her class. Yet the elements requisite to a sea-boat of the highest grade have been somewhat sacrificed in these ships in favor of massive armor and heavy guns, making them, in the opinion of naval engineers, the most powerful fighting ships in the world.

The building of the Iowa was authorized by Congress July 19, 1892, her keel was laid August 5, 1893, she was launched March 28, 1896, and commissioned June 16, 1897, so that she was less than a year in service when called to take part in the war with Spain.

FIRST-CLASS BATTLE-SHIP IOWA.

Her builders were William Cramp & Sons, of Philadelphia, and her contract price $3,010,000. The Iowa has a load-line length of three hundred and sixty feet, with seventy-two feet breadth of beam, and a mean draught of twenty-four feet. She is fitted with twin-screw, vertical, triple-expansion engines, capable of producing 12,105 horse-power, and on her trial trip showed a speed of 17.087 knots per hour, the highest possessed by or estimated for any of our first-class battle-ships. Her displacement is 11,340 tons, and she is capable of carrying a maximum coal supply of eleven hundred and ninety-seven tons.

The Iowa, for the purpose of adding to her sea-going powers, has been given a higher freeboard than the ships of the Oregon class, her sides having been raised eight or nine feet, or about the height of an extra deck, from her bow back to the aft 8-inch turrets. Her freeboard is thus about twenty feet forward and twelve feet aft, while the Oregon has but about twelve feet throughout her length, a flush deck extending in this vessel the whole length from bow to stern. This structure of the Iowa lifts her forward pair of heavy guns about twenty-five feet above the water at normal draught, placing them beyond the reach of head seas, while in the Oregon and her sister ships, if steaming head to sea in heavy weather, green water would be liable to roll over the corresponding guns.

Weight is reduced in the Iowa by a thinning of her side armor-belt, which is of 14-inch Harveyized steel, covering the ship on each side for a length of one hundred and ninety-six feet and a breadth of seven feet six inches, of which three feet lie below the water-

line. This belt, which tapers to six inches at the lower edge, has a backing of twelve inches of solid timber. The bulkheads, which cross the ship from end to end of the side armor, are of 12-inch steel. Above this citadel stretches a protective deck of 2¾-inch steel, which is continued from the citadel to the two ends of the vessel.

Above the heavy armor-belt what may be designated as a second citadel is built, its side walls being of 4-inch steel and extending one hundred feet fore and aft, while its diagonal bulkheads connect with the main barbettes. Belts of cocoa cellulose are laid behind the armor-belt to prevent the inrush of water in case it is pierced. It is believed that this upper armor will have sufficient resisting power to cause projectiles charged with high explosives to be destroyed by their own impact before they can penetrate to the interior of the ship.

The hull, like those of the other ships named, is built on the cellular system, its water-tight compartments being numerous, while much attention has been given to the formation of such compartments through the interior of the ship.

The character and disposition of turrets and guns in this vessel resemble the arrangement in ships of the Oregon type. Amidships, at either end of the armored citadel, rise barbettes with 15-inch armor, from which emerge turrets protected with steel of the same thickness. Each of these turrets carries two 12-inch breech-loading rifles.

Between the main turrets and well out on the sides of the ship are four smaller turrets, two on each side, carrying in all eight 8-inch rifles, each of which can

hurl a 250-pound shell with a force sufficient to penetrate eight inches of solid iron two miles away. These are armored with 8-inch steel. The main battery of the Iowa also includes six 4-inch rapid-fire guns, capable of discharging 33-pound shells in such quick succession that five of them may be in the air at the same time between the ship and the mark.

In addition to this powerful main battery, the Iowa carries on her superstructure deck, her bridge, and her military masts a secondary battery comprising twenty 6-pounder and six 1-pounder rapid-fire guns, four Colt machine-guns, while below she carries four torpedo-tubes provided with Howell torpedoes. The Iowa is the only ship of our navy which has torpedoes of this make. The single mast has three military tops, increasing her powers of sending a plunging hail of balls from her small guns. A striking feature of this ship is the height of the two smoke-funnels, which tower one hundred feet above the grate-bars, this elevation enabling them to give good results from natural draught, and reducing the necessity of using forced draught. Stout torpedo nettings, reaching from water-line to keel, may prove of much value as a defence against the work of torpedo-boats.

The Iowa differs from the ships of the Oregon type by carrying the 12-inch guns in her forward main turret and the 8-inch guns in the side turrets on the same level,—twenty-five feet above the water-line. The large guns in the aft turret stand at a lower level, that of eighteen feet. With her large coal capacity, this ship is capable of steaming at a speed of ten knots an hour for thirty-one days, or over a distance of seven thousand five hundred knots, without recoaling. The

spar-deck forward is of great advantage to the crew, adding much to the berthing room, and assuring them a degree of comfort which cannot be provided in ships of less height above the water.

On March 2, 1895, Congress authorized the addition to our battle-ships of two others, to cost $2,250,000 each, their designation, like that now given to all our first-class battle-ships built or building, being "sea-going coast-line battle-ships," this composite designation having replaced the former separation into distinctively sea-going and coast-line ships. These two vessels, known as the KENTUCKY and the KEARSARGE, were contracted for January 2, 1896, by the Newport News Ship-building Company, and their keels were laid June 30 of the same year. Their contract date of completion is January 2, 1899, but the exigencies of the situation will probably cause their actual completion considerably before that date.

These two noble ships are each three hundred and sixty-eight feet long, seventy-two feet beam, and are to draw twenty-three feet six inches of water and show a displacement of 11,525 tons. Their engines are of the twin-screw, triple-expansion type, the estimated horse-power being 10,000, the speed sixteen knots. The normal coal supply is four hundred and ten tons, but bunker capacity has been provided for twelve hundred and ten tons, giving an estimated cruising range of six thousand knots.

These great vessels carry a powerful protective armor of Harveyized steel, covering the sides to four feet below and three feet six inches above the waterline. It has a thickness of sixteen and a half inches at its upper edge and tapers downward to nine and a

half inches at the lower edge. The athwartship bulkhead is of 10-inch steel forward and 12-inch aft. The protective armor extends from the after turret to the stern, of full thickness except just at the bow, and over all is laid a protective deck of $2\frac{3}{4}$-inch steel. This deck has, like the protected cruisers, sloping sides, extending downward to some distance below the water-line, and affording protection to the front and rear sections of the hull. The slopes are of 3-inch steel forward and 5-inch aft. In place of the cocoa-fibre packing used in the ships already named, the newly invented corn-pith cellulose is employed in these, and is to be used in the other battle-ships now building, its advantage being its greater lightness and its superior resistance to the entrance of water. It has also the important quality of being incombustible. In the tests of this material duplicate coffer-dams were constructed, one being packed with cocoa-fibre and the other with corn-stalk cellulose. Into each of these a 6- and an 8-inch shell were fired. Water was then forced into the dams under pressure. The result was that the water soon oozed through the cocoa packing but failed to penetrate the corn-pith, which proved to be completely water-tight, swelling when wet so as hermetically to seal the rent. This material, which has the further advantage of being an abundant home product, has therefore been chosen by the Navy Department as what is technically known as an "obturating" substance.

The special characteristic of these vessels is in the arrangement of their armature, which is distinctively a new departure, and one which shows the ingenuity of the American mind. In fact, a distinct step forward

was taken in constructing the battle-ships of the Oregon pattern, their batteries differing from those of any ship then afloat. It was a daring and novel conception to flank the 13-inch guns of the main turrets with eight 8-inch turreted guns, placed at a height above the water-line that gave them an open field for training. European engineers doubted that so heavy an armament could be successfully carried, but trial has proved that the Oregon and her sister ships are quite capable of performing all that was claimed for them. In fact, they more than fulfilled expectations, except in one particular, and the defect in this point it was sought to overcome in the Kentucky and the Kearsarge by an innovation still more radical and daring in conception.

The weak feature in the Oregon type of armament is the following: It proved unsafe to train the 8-inch and 6-inch guns through as wide an arc of the horizon as had been intended. In the original design it was expected that the 8-inch guns would be serviceable both for broadside and for direct forward and aft fire, and might be trained through a considerable arc on the opposite beam, thus sweeping over much more than half the circle of the horizon. With this idea in view they were placed high, in order that they might fire across the tops of the main forward and aft turrets. It was found, however, on trial that this could not be done, the blast from their fire being so powerful that the sighting hoods of the main turrets could not be used. The farthest they could be trained was 80 degrees forward and aft of the beam, and it became necessary to place stops to prevent their being swung within 10 degrees of the axial line of the ship. There

was also an interference between the fire of the 13-inch and the 6-inch guns, which prevented the latter from firing dead ahead and astern.

These difficulties, it is true, are not serious. Battle-ships are little likely to engage end to end, and for broadside firing the whole battery of these ships is available. Yet the interference in fore and aft fire was foreseen when the plans for the Kentucky and the Kearsarge were made, and the supposed defect was got over in an ingenious manner, which is without counterpart in any other of the world's ships of war.

Instead of providing separate turrets for the 13-inch and 8-inch guns, it was decided to make two-storied turrets, a smaller turret for 8-inch guns being placed on top of each of the 13-inch turrets, the double turret revolving as one, and its four guns all firing in the same direction. The fire of the four guns in each double turret can be concentrated either directly ahead or directly astern, while the whole fire can be combined on either broadside, each turret revolving through an arc of 270 degrees.

The design of these vessels has called forth considerable adverse criticism, based on the possibility that the blast of the 8-inch guns would cause serious inconvenience in the 13-inch turrets beneath. But experiments carried on at the Indian Head proving-grounds with improvised platforms go to prove the contrary, and indicate that no such difficulty will arise. There are other objections, however, made to the double-turret system, naval experts holding that the several gun stations on a ship should be as far apart as possible, so that a successful shot from an enemy

may not do too great an amount of damage to the guns.

Thus, if in a contest some successful shot should wreck the lower section of a double turret, the upper section would at the same time be rendered useless, while, on the other hand, a shell might penetrate the lighter armor of the upper section, and by wrecking the turning gear below render useless all four of the guns. Again, as the two turrets revolve as one, the four guns must always point in the same direction, while in the course of a fight it might prove desirable to train the 13-inch guns in one direction and the 8-inch in another. All these questions were fully considered before ordering these vessels, and the double turrets adopted as presenting more advantages than defects. But the system has not been chosen for the battle-ships ordered since.

The Kentucky and the Kearsarge have been very stoutly built, the beam being in a large proportion to the length, speed having been somewhat sacrificed to enable these ships to stand the shock of fire of so many heavy guns at one point, and to prevent misfire through oscillation of the ship. The turrets are strongly protected by steel armor, the barbettes having 15-inch armor in front, 12-inch in rear; the lower turret 17-inch in front, 15-inch in rear; and the upper turret 11-inch in front, 9-inch in rear. The $2\frac{3}{4}$-inch steel deck slopes down at the sides, thickening to three inches on the forward and five inches on the rear slope. All this armor is of Harveyized nickel steel.

We have described, however, only a portion of the powerful main armament of these great war monarchs. Their dispensing with side turrets has left room for

a broadside battery of great effectiveness. This consists of fourteen 5-inch rapid-fire guns, seven on each broadside. These are ranged along the main deck in a central battery between the two turrets, each gun having an effective range of 90 degrees. They are protected by six inches of steel armor.

The shells thrown by these guns are much lighter than those of the 8-inch, in the proportion of 50 to 250 pounds. But this decrease in weight is in a measure made up by their much greater rapidity of fire. In a single minute one of these 5-inch batteries could belch from its iron muzzles fifty-six of these 50-pound shells, or a total of nearly three thousand pounds of steel, at a velocity of two thousand three hundred feet a second, its striking power being equivalent to the enormous total of 102,704 foot-tons. This power, if applied to the ship itself, would be sufficient to lift it bodily nine feet into the air.

Something further may fitly be said here about the huge instruments of destruction, the great 13-inch guns, with which nearly all of our battle-ships are provided. These great steel tubes, forty feet long and weighing over sixty tons each, are competent to throw an 1100-pound shell, with a reasonable degree of accuracy, through a range of twelve or thirteen miles, and with a force of impact capable of penetrating over thirty-four inches of wrought iron at their muzzles, and twenty-two inches at a mile's distance. The maximum range, however, cannot be had on shipboard, since it would require so great an elevation that the recoil would be apt to drive the heavy gun, like a huge battering-ram, down deep into the vitals of the ship, doing far more harm within than its massive shell

is likely to do without. The elevation, therefore, needs to be reduced, but the great shell can be hurled for five or six miles with exact aim and destructive effect.

The utility of these great guns in actual warfare, as compared with smaller and more active ordnance, is a debated question. Their ammunition is so heavy that only a moderate number of discharges can be provided for, while the effect upon the guns themselves of their employment is such as to render them useless before they are long in service. Warfare conducted with such weapons is, therefore, enormously expensive, and in the naval warfare of the future the greatest dependence will probably be placed on the smaller, less costly, and more easily handled and quickly fired guns.

One further item of information may be given here. In most of our ships of war hydraulic or steam power is employed for turning the turrets and the other operations calling for power within the ship. In one instance, that of the monitor Terror, as already described, compressed air has been substituted for these purposes, and very effectively. In the Kentucky and the Kearsarge, on the contrary, electric power has been introduced. Only one other ship is provided with this new agent of power, the Brooklyn, two of whose turrets are moved by steam and two by electricity. In the three battle-ships of the Alabama pattern, now building, a return has been made to the hydraulic system.

On June 10, 1896, Congress authorized the construction of three more first-class battle-ships, which were contracted for in September of the same year, three years being allowed for their construction.

FIRST-CLASS BATTLE-SHIP KEARSARGE—SHOWING DOUBLE TURRETS.

These were distributed among the three principal ship-building firms, the Alabama being assigned to the Cramps' yard at Philadelphia, the Wisconsin to the Union Iron-Works at San Francisco, and the Illinois to the builders of the Kentucky and the Kearsarge, the Newport News Ship-building Company. These three ships are being hurried to completion, and will probably assume their place in our navy much before their contract time. In April, 1898, the building of three more battle-ships was authorized, which, when completed, will give the United States a fleet of twelve first-class battle-ships, each quite capable of holding its own against any ship in the world. The tendency in this country has not been to emulate the great 14,000- or 15,000-ton floating fortresses built abroad, it being held that equal strength and fighting capacity, with greater mobility, could be attained with vessels of smaller weight. None of our battle-ships, therefore, are over 11,525 tons displacement,—the weight assigned to the three just named and their two predecessors.

The ALABAMA, launched in May, 1898, may be described as the type of these three sister ships. In size she exactly accords with the Kentucky, being three hundred and sixty-eight feet long, seventy-two feet two and a half inches beam, and twenty-three feet six inches mean draught. Her proposed power and speed are also the same, the plans demanding 10,000 horse-power and sixteen knots of speed. Her normal coal capacity will be eight hundred, and her full bunker capacity twelve hundred tons. Like the Kentucky, also, she will have two military masts, and similar armored protection, the only difference being

that the slope of the aft steel deck will be of 4-inch steel, instead of 5-inch as in the Kentucky.

The general similarity here indicated does not apply to armament, the double-turret system of the Kentucky being discarded, while the Alabama discards also the 8-inch guns of our preceding battle-ships, replacing them by a marked addition to the weight and power of her secondary battery. The round turret is here replaced by what is known as the elliptical type, the Alabama turrets being of oval shape, with a slight slope to the front plates, the rear plates being vertical. This form has the advantage of being lighter and giving more room at the rear of the guns than in the circular turrets. It is thus an advantage to the gun-crews in handling and loading their pieces. The turret overhangs the barbette in the rear, but is well balanced and can be revolved with considerable ease, even when the ship has a heavy list. In this particular it is superior to the circular turret. The barbettes are protected with 15-inch steel armor in front and 10-inch in rear; the turrets with 17-inch front and 15-inch rear armor. Three sighting-hoods are provided, one near the front edge of the roof and the others at the two sides. Of these, the centre hood is for the use of the man who turns the turret, and whose duty it is to keep the guns always bearing upon the target, while the others are occupied by the gun-pointers, who elevate or depress the guns.

In one particular the ships of the Alabama class differ from those of the Kentucky and resemble the Iowa, their sea-going powers having been increased by the addition of a spar-deck from the bow of the ship back through three-fourths of her length, the

freeboard being thus increased to twenty feet in the Alabama as compared with the thirteen feet of the Kentucky. The forward turret stands on this spar-deck and is elevated to a height of twenty-six and a half feet above the water-line. This will enable the guns to be fought even when the ship is plunging head on into a heavy sea, which might prove troublesome in the case of ships whose forward guns lie seven or eight feet lower.

The after turret stands at the lower level of the main deck, thus aiding the stability of the ship, which would be endangered were both these heavy turrets carried at so great a height. The 8-inch guns of the earlier vessels are replaced by a much stronger secondary battery, since the 5-inch rapid-fire guns of the Kentucky are represented in the Alabama by a battery of fourteen 6-inch rapid-fire guns, a difference in size which is equivalent to a doubling in weight of the projectile, shells of 100-pound weight taking the place of the 50-pound shells of the 5-inch guns. While the latter are capable of penetrating thirteen inches of wrought iron at their muzzles, the 6-inch guns have a greater muzzle velocity and a penetrating power of 15.6 inches.

The battery of the Alabama is also better arranged, and the gunners have more protection. Eight of the guns will occupy a central battery on the main deck, four on each side, their protection being an armor-belt of 5½-inch steel. Two more, similarly protected, will be placed on the same deck in the bows, while the remaining four guns will be mounted on the spar-deck, behind protecting walls of 6-inch steel. The latter will be able to fire dead ahead and dead astern

as well as broadside. A full broadside from this battery of 6-inch guns will have immense power, and be capable of making serious havoc in the unprotected or lightly armored portions of an enemy's ship.

The secondary battery comprises sixteen 6-pounder and four 1-pounder rapid-fire guns, one Colt machine- and two field-guns, while below four long Whitehead torpedo-tubes are provided. In one respect the Alabama type differs from the other ships of our navy in carrying her smoke-stacks abreast each other instead of fore and aft. This is a system borrowed from abroad.

In concluding our notice of the battle-ships of the United States navy, it may be repeated that they have no superiors in the world, carrying not only heavier armor and guns than ships of equal displacement in other navies, but surpassing in this respect some foreign ships of considerably heavier weight. Thus, the British ship Majestic, with a displacement of 15,000 tons, carries four 12-inch guns against the four 13-inch of nearly all our battle-ships, while her twelve 6-inch guns are surpassed by the fourteen of the same size on the Alabama and her sister ships. The protection of the latter also is greater, the side and turret armor alike being thicker. The greater coal and ammunition capacity of the large foreign ships is about the only thing to be said in their favor, this condition being of less importance to our ships, as they are likely to have shorter journeys to make.

In this connection it seems advisable to quote from an article by an eminent English naval authority, published in the *Fortnightly Review* of July, 1894. After

giving an analysis of the United States navy, built and building, he says,—

"This is a modern fleet superior, upon the whole, to any modern fleet in existence, the fleets of Great Britain, France, Italy, Russia, and perhaps Germany only excepted, and most of the vessels have not, I believe, their betters of similar class in any navy. To some of these vessels I would call particular attention, since there is no doubt that the value of a fleet depends quite as much upon the quality as upon the mere number of units composing it, and since, in respect of the qualities of some of its newer ships, the United States assuredly stands far ahead of the rest of the world to-day."

Taking the Iowa and the three ships of the Indiana class, he compares them, point for point, with the British ship Renown and the French ship Jaureguiberry, which he considers the finest battle-ships of about the same size belonging to these two nations. He proceeds:

"It will be observed that the Indiana and Iowa compare unfavorably in the matter of speed with both the Renown and the Jaureguiberry; but in almost every other respect they seem to be immensely, nay, crushingly, superior. And I do not consider great speed as of supreme importance to the battle-ship. What, for example, would be the value, in practice, of the Renown's superior speed as against the Indiana? It might, it is true, enable our ship to force an action; but, with an opponent so greatly superior in gun-fire, our ship could scarcely hope, other things being equal, to achieve success. If the two ships engaged bow to bow, stern to stern, or bow to stern, the United States

ship could deal blows much more numerous than those of the British ship, and in the aggregate nearly thrice as heavy. Even if they engaged broadside to broadside, the aggregate energy of the American fire would be much more than double that of the British.

"Put our huge Royal Sovereign or our coming Prince George as our champion instead of our Renown, and we will not fare much better, for the Americans distribute their guns more advantageously than we do, and their battle-ships which I have cited represent more sensible compromises of the rival claims of speed, radius of action, gun power, and armor than any of ours. If our battle-ship be unequal to the task of engaging another battle-ship of inferior displacement, superior speed will avail the former little, unless to enable her to run out of danger. Yet is not the main object of a battle-ship, after all, to fight? In the war of 1812 we were obliged, much against our will, to take lessons from the United States on the subject of the proper way of gunning frigates. We might do worse now than take lessons from the United States on the subject of the proper way of gunning battle-ships; and also of gunning cruisers, for the American cruisers are as superior to ours as the American battle-ships are."

After this tribute to the splendid character of our ships of war from an authority across the waters, nothing more need be said. Enforced praise like this from an admiring rival bears greater weight than anything a patriotic American could say.

CHAPTER V.

THE CRUISERS NEW YORK AND BROOKLYN.

We have dealt with the line-of-battle ships of the new American navy, and now must devote attention to its frigates, or their recent counterparts, the cruisers, the light cavalry of the seas, whose duty it is to patrol the ocean, keeping keenly on the watch for an enemy's ships, convoying merchant vessels or capturing those of the foe, seeking and fighting the regular and auxiliary cruisers of the hostile fleet, dashing home at top speed with despatches, and performing other duties that call for swiftness, alertness, and strength. Such a ship needs to be a good sea-boat, with lofty freeboard, adapting her to steam at high speed in rough weather. She needs to be considerably swifter than the battle-ships, and to be provided with powerful engines and large coal capacity, so that she may keep long afloat; she needs berth-room for a large crew, since the capture of prizes may demand the sending out of prize-crews; and she must be strongly enough armed to fight with ships of her own class, though not fitted to stand against the massive guns of the great fighting ships.

The United States navy is fairly rich in ships of this class, having twenty in all, variously designated as armored, protected, and unprotected cruisers. In this chapter it is proposed to deal with the first of these, the

armored cruisers, of which we possess two, strong and swift steeds of the ocean, fitted to make a gallant record against the less massive battle-ships, while there are few lesser ships that float on the waves that could safely join in battle these proud lords of the open seas.

The cruisers began as wooden vessels, made to run, not to fight, except with craft of their own type. From these emerged the protected cruisers, still with hulls of timber, but with decks of steel, from which any ball coming at an angle would be likely to glance and end its career uselessly in the ocean wave. The final stage of evolution was into the armored cruisers, with a side belt of steel, much thinner than that of the battle-ship, yet having fair resisting powers, while they carry heavier guns, shielded by thicker armor, than the other ships of their class, and maintain their requisite of high speed. Our navy has at present two cruisers of this class, the New York and the Brooklyn, which call for particular attention at our hands.

Of all the ships of the United States, the great armored ocean greyhound NEW YORK stands first in public estimation, it being apparently the most widely known and most admired war-vessel afloat upon our seas. And this appreciation seems not confined to the people at large, but appears to extend to naval officers as well, if we may judge from the fact that Admiral Sampson has chosen this noble vessel as the flag-ship of his fleet, in preference to the battle-ships that keep it company. Doubtless it is to its useful union of strength and speed that it owes this flattering choice.

Certainly our navy has no handsomer ship than the

ARMORED CRUISER NEW YORK.

New York, her nearest rival in this respect being the Brooklyn, for which she furnished the type. Her high speed, great power, and fine proportions brought her into general favor at her first appearance, and went far to teach naval experts abroad that the republic of the west proposed to be second to none in the quality and performance of its ships. In the great naval demonstration at Kiel, Germany, in June, 1895, when all the nations of Europe sent their proudest vessels to take part in the ceremonies at the opening of the Baltic Ship Canal, the New York was selected to represent the United States. While there she attracted universal attention and was visited three times by the German Emperor, who dined aboard on one of those occasions and after dinner, about midnight, inspected the machinery of the ship. In the course of this inspection, without any warning, William II. (who by the way was supposed to be, by courtesy, in command) suddenly ordered the forward and after engines to be disconnected, which to his amazement was done in two minutes and forty-six seconds. He made an exhaustive inspection of the ship and in all respects paid more attention to her than to any other vessel engaged in the demonstration. On her return trip she crossed the ocean in two hundred and forty-two hours under half-boiler power and two engines, natural draught.

The New York represents what may be considered the second epoch of construction in the development of our new navy. Before her appearance a displacement of 4500 tons and 10,000 indicated horse-power were as high as American aspiration reached in the building of cruising ships. The Maine and Texas,

indeed, were somewhat larger than this, but the latter of these was designed as a battle-ship, and the former became classed as such, her make-up carrying her beyond the level of the cruiser class. The New York doubled the Texas in horse-power, her rating being 17,401 to the 8610 of the battle-ship. She also largely surpassed the Texas in displacement, showing 8200 tons to the 6315 tons of the latter. In engine-power, indeed, she is largely in advance of any of our battle-ships, the most powerful of which is the Iowa, with about 12,000 horse-power, while the New York shows a motive power of nearly half as much more. This high power was necessary for the great speed demanded of her, which reached on her trial trip the high ultimate of twenty-one knots.

The New York was authorized by Congress in 1888, being the chief among eight new vessels called for at that time. She was built by the Cramps, at Philadelphia, her keel being laid in 1890 and the ship completed and put in commission August 1, 1893. The New York is, with the exception of the Brooklyn, the longest vessel in our navy, her total length on water-line being three hundred and eighty-four feet. Her extreme breadth is sixty-four feet ten inches, and her draught a little over twenty-three feet. She is thus longer and narrower than any of our battle-ships, her lines being adapted for speed, not for massiveness and stability, as in the latter. She was built at a contract price of $2,985,000.

The design of the New York was a marked departure from the preceding policy of our Navy Department. Her predecessors had been fast protected cruisers like the Baltimore, or comparatively slow

fighting ships like the Texas. In her features she presents a combination of the two, while as a whole surpassing both. While her speed was increased more than three knots over the Texas, her armor was considerably reduced in weight, yet remained strong enough to give good protection to her vital parts and afford a strong cover for her main battery. In respect to provision for the comfort of officers and men and to general equipment she stands high in the rank of war-ships, while there is no vessel of her rate and class in foreign navies that equals her in economy and efficiency.

The New York has a double bottom three feet six inches in width, divided into eleven water-tight compartments, while the entire ship has one hundred and eighty-four of these life-saving divisions. Along the water-line, extending the entire length of the ship and through a width of three and a half feet, is a coffer-dam filled with cocoa cellulose, for protection against the entrance of water in case of the penetration of shot or shell. The quantity of cellulose used is considerably greater than that of any of our battle-ships, perhaps from its being considered more necessary. The total coal capacity of the New York is twelve hundred and ninety tons, a quantity sufficient to enable her to steam more than half the round of the earth.

The protective armor-belt of the New York is composed of 4-inch nickel steel, and extends amidships through about half the length of the ship and through eight and a half feet of width, the safety of the engine and boilers being the main purpose designed. Her protective deck carries a 3-inch thickness of nickel steel on the flat and 6-inch on the slopes, which pass

down within the hull from a point one foot above to nearly five feet below the water-line, thus adding effectively to the defence afforded by the outer belt of steel.

The armament of the New York is powerful for a vessel of the cruiser class, her main battery consisting of six 8-inch rifled guns, which her high freeboard enables her to carry twenty-five feet above the water. These guns occupy three turrets protected by 5½-inch nickel steel, and rising out of barbettes of 10-inch steel armor. She carries in addition twelve 4-inch rapid-fire guns in sponsons of 4-inch steel. The "sponson," it may be said here, is a curved projection from the ship's side, provided for many of our war-vessels, in order to give the guns freer play and a wider range of aim.

The secondary battery consists of eight 6-pounder and two 1-pounder rapid-fire guns, four Gatlings, and two field-guns, while two Whitehead torpedo-tubes are provided. These are carried on her superstructure deck and her two military masts, the latter being placed fore and aft, while between them the three smoke-stacks rise in a line along the axis of the ship.

The engines of the New York present a novel arrangement. She possesses four complete triple-expansion engines, each of the twin screws being driven by two of these engines, coupled together and working on the same shaft. The purpose of this arrangement is to save power during ordinary cruising, when the forward engines are uncoupled and only the rear ones used. Six double-ended main boilers and two single-ended auxiliary boilers supply steam to these engines, the strength and power of the arrangement having proved sufficient to drive the great ship

through the water on her trial trip at a speed of twenty-one knots for four hours in succession. The propellers are three-bladed screws made of manganese bronze, sixteen feet in diameter and with twenty-feet pitch.

In July, 1892, Congress gave authority to the Navy Department to construct a second ship of the same type as the New York. This vessel, named the Brooklyn, was also contracted for by the Cramps, the contract price being $2,986,000. Her keel was laid on August 2, 1893, and the vessel commissioned by the Department December 1, 1896.

The BROOKLYN is a larger vessel than the New York, being four hundred feet six inches in water-line length, sixty-four feet eight inches beam, with a mean draught of twenty-four feet. Her displacement is 9215 tons, and her indicated horse-power 18,769, this great power giving her a trial-trip speed of 21.91 knots. Her coal capacity is somewhat greater than that of the New York, running up to fourteen hundred and sixty-one tons. The engines of the Brooklyn resemble those of her prototype in number and arrangement, and the same is the case with the working parts of her machinery in general. As she sits in the water, however, she presents a different appearance from the New York, bearing an unusually high forecastle deck, while her three lofty smoke-stacks overtop her military masts, to which they give a squat appearance. In these respects she lacks something of the grace of her sister ship; but fighting power, not good looks, is the purpose of her existence, and these features aid her efficiency as a ship of war.

The lofty forecastle, for example, lifts her forward

pair of 8-inch guns considerably higher than those of the New York, they standing about thirty feet above the water, a height of whose value when heavy seas are running and the ship plunging through combing billows we have already spoken. The lofty smoke-stacks, which are one hundred feet in full height, are also of value, as enabling her to dispense with forced draught, with its frequent injury to boilers. Lofty smoke-stacks are found to give as good results with natural draught as can be had with forced draught and low stacks.

The military masts of the Brooklyn are larger than those of the New York. This is particularly the case with the foremast, which is carried up to the first fighting-top of the full size of the conning-tower. The side protection is somewhat less, 3-inch steel in the Brooklyn replacing the 4-inch steel of the New York. The protective deck, however, is of the same thickness, both on the flat and the slopes, and an equal weight of cocoa packing is employed.

The battery of the Brooklyn surpasses in power that of the New York, she carrying eight 8-inch rifled guns, which are mounted in four turrets, two on the middle line forward and aft, and two amidships, sponsoned out on the opposite sides. These guns are protected by 10-inch barbettes, enclosing the bases of revolving turrets armored with 6-inch Harveyized steel. The 4-inch guns of the New York are replaced here by 5-inch guns, twelve in number, each capable of firing a 50-pound shell with a muzzle velocity of 2300 feet per second and a penetrating power equal to twenty-three inches of wrought iron. Eight of these guns are carried on the gun-deck and four on

the main deck above, all being sponsoned out on the ship's sides and protected by four inches of Harveyized steel. The guns are so arranged that no interference will take place between them, and a powerful concentrated fire can be had ahead or astern, or on either broadside. The secondary battery is also stronger than that of the New York, consisting of twelve 6-pounder and four 1-pounder rapid-fire guns, four Colt machine-guns, and two field-guns, while she carries four Whitehead torpedo-tubes.

The distinguishing feature of the Brooklyn is the enormous berthing space for her crew. While the New York is very commodious and well ventilated, having two complete living decks—the berth- and the gun-decks—extending the whole length of the ship, the Brooklyn surpasses her not only by the twenty feet greater length of these decks, but by her additional forecastle, one hundred and nineteen feet long, the whole space being clear except that taken up by the forward barbette with its nearly twenty feet of width. By adopting the usual navy regulations for berthing space, the Brooklyn could easily find sleeping-room for a thousand men, or about double her ordinary crew. This characteristic will give her unusual value when in service on distant stations, in enabling her to carry a large reserve force for any squadron of which she may be the flag-ship.

While the engines of the Brooklyn are of the same type as those of the New York, there are some differences worth noting. All the main columns are of cast steel, instead of cast iron as in the New York, their weight being thereby reduced about twenty-five per cent. The boiler arrangement is also different,

and gives a considerably greater grate and heating surface, thus adding to the steam-making efficiency.

The estimation in which this fine ship is held in the navy is shown by her having been selected by Commodore Schley as the flag-ship of his squadron. The New York and Brooklyn thus hold the post of honor in the two West India squadrons into which our Atlantic fleet is at present divided, and bear aloft the pennants, the one of an admiral, the other of a commodore.

It will be perceived that in the four years that elapsed between the building of these two fine cruisers a development of ideas had taken place, with the result of producing in the Brooklyn a larger, more commodious, and in various respects more powerful and efficient ship than was attained in the New York. These two armored cruisers have given such satisfaction, alike to the Department and the public, by their performance, that there exists a strong sentiment in favor of adding to their number. At present the great shipyards of the country are actively engaged in increasing our list of battle-ships, while several are authorized which are not yet under contract; but it is very probable that in the time to come more attention will be given to the very useful class of ships here considered, and our fleet of armored cruisers will be considerably augmented, thus adding to the strength of the navy in a field in which it is at present deficient, and rounding up the circle of our ships.

CHAPTER VI.

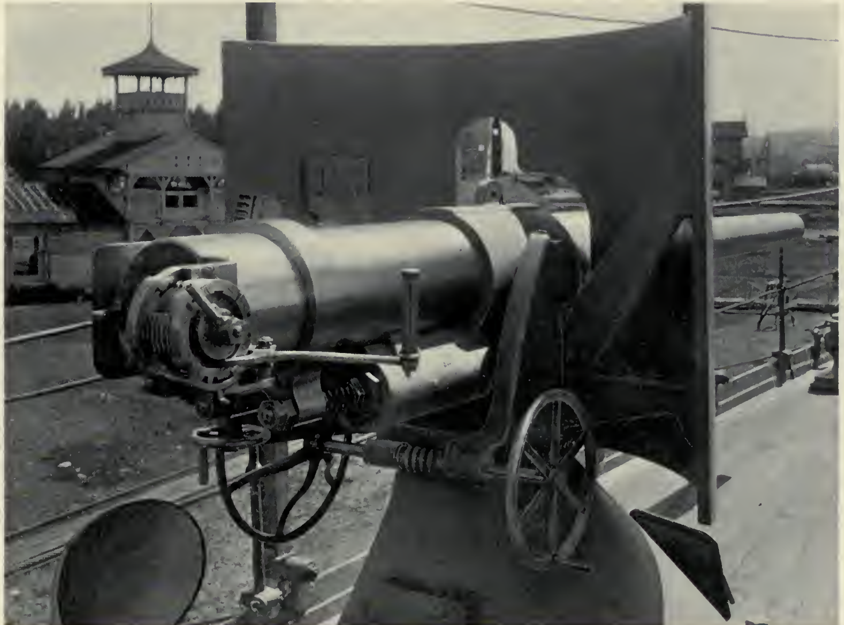
THE PROTECTED CRUISERS OF OUR NAVY.

WITH what are known as protected cruisers the United States navy is fairly well supplied, there having been built thirteen of this class of vessels, all of which are in commission, and several of them notable for high speed and other valuable qualities. The protection consists in their having an armored deck, with steel sides sloping downward to some distance below the water-line. It was with vessels of this class that our new navy came into existence, three such cruisers having been authorized in 1883. These were the Atlanta, the Boston, and the Chicago, all built at the ship-yard of John Roach & Sons, Chester, Pennsylvania. By the terms of the contract they were to be completed in January, 1885, but delays took place for reasons which we need not here specify, and these ships came into commission successively in 1886, 1887, and 1889. At the beginning of 1890, therefore, these three small cruisers and one other, the Charleston, formed the whole available American navy, except the ships of obsolete pattern remaining over from our old-time fleet and the decaying old monitors laid up in ordinary at the navy-yards. The first armored cruiser of the United States was commissioned in 1893, and we did not have a battle-ship in commission until 1895. In 1890, therefore, we should have made a sorry show

against even so weak a power as Spain, the proud navy we have now afloat having come into existence in the years succeeding, and the bulk of it having been in condition for service for very few years.

What, then, was the character of the ships with which our navy began? Of those named, the ATLANTA and the BOSTON are of the same design, rated as brigs, their length slightly over two hundred and seventy-one feet and breadth forty-two feet, with a draught of sixteen feet ten inches, and a displacement of 3000 tons. Their power is derived from single-screw, horizontal, compound engines, and amounts to 4030 horse-power, yielding a speed of 15.6 knots per hour. They are, in addition, provided with sails, for use when speed is not of special importance. The protection of these pioneer vessels consists in a steel deck one and a half inches thick, alike on flat and slopes. They carry heavy batteries for vessels of their dimensions, comprising two 8-inch breech-loading rifles and six 6-inch rapid-fire guns, with a secondary armament of two 6-pounder, two 3-pounder, and six 1-pounder rapid-fire guns, two Colt machine-guns, and one field-gun.

Their companion boat, the CHICAGO, is rigged as a three-masted schooner, and is of larger size, being three hundred and twenty-five feet long, forty-eight feet wide, and of nineteen feet draught, with a displacement of 4500 tons. Her horse-power is estimated at 9000 and her speed at eighteen knots, she being provided with engines of the twin-screw triple-expansion type. The Chicago has the same protection as the other vessels named, a deck armor of 1½-inch steel. Her guns, however, are numerous and



FOUR-INCH RAPID-FIRE GUN.

powerful, embracing four 8-inch rifled cannon and fourteen 5-inch rapid-fire guns, with a secondary armament of seven 6-pounder and two 1-pounder rapid-fire guns, two Colt machine-guns, and one field-gun.

The next additions to the American navy were the protected cruisers Charleston and Newark, authorized by Congress, March 3, 1885, the former, built at San Francisco, being put in commission on December 26, 1889, and the latter, built by the Cramps, on February 2, 1891. The CHARLESTON is of 3730 tons displacement and 6666 horse-power, with a speed of 18.2 knots. She has discarded sail-power and is provided with two military masts. The protection of this vessel surpasses that of those just named, her deck being of 2-inch steel, which thickens to three inches on its sloping sides. The plans for this ship were purchased abroad, from the Armstrongs of England, but were considerably revised by the Union Iron-Works, her builders. Her dimensions are three hundred and twelve feet seven inches length, forty-six feet two inches beam, and eighteen feet seven inches draught. Her engines are of the horizontal type used in many of the earlier vessels of our navy. Engines of this character were at first deemed necessary, as their cylinders could be placed well below the water-line, out of danger from shot or shell. But the use of the protective deck, and of coal-bunkers flanking the engine-room on each side, has rendered it safe to introduce vertical engines in our later ships. The greater steam-pressure now employed and the higher piston speed have greatly shortened the stroke, so that the cylinders now in use are of reduced height and their tops can be brought well down to the water-line.

The Charleston carries a main battery of two 8-inch and six 6-inch breech-loading rifled cannon, and a secondary battery of four 6-pounder, two 3-pounder, and two 1-pounder rapid-fire guns, four Hotchkiss revolving cannon, two Colt machine-guns, and one field-gun. The 8-inch guns are placed one forward and one aft, and the 6-inch are sponsoned out on the sides, and protected by shields of steel. This vessel has seen considerable service on the Pacific coast, and in late May, 1898, was despatched across the ocean to the Philippine Islands to strengthen Admiral Dewey's fleet.

The NEWARK is of practically the same dimensions as the Charleston, though one foot shorter and three feet wider. She is, however, heavier and of greater steam-power, her displacement being 4098 tons and her engines of 8869 horse-power, giving her a speed of nineteen knots. She is schooner-rigged, with three masts. Her steel decks are of the same thickness as those of the Charleston, but her armament differs, the main battery consisting of twelve 6-inch rapid-fire guns and the secondary of eight 6-pounder and four 1-pounder rapid-fire guns, four Colt machine-guns, and one field-gun.

It is worthy of remark that the Newark is the last protected cruiser of the new navy to be provided with sail power, her rig being a compromise between the new and the old school. Her sails are found to be rather an injury than a service, they acting as a resistance instead of a help to the ship when at full speed. This ship performed the service of convoying the Columbus caravels across the ocean, from Palos, Spain, to the American coast. She afterwards took

part in the Columbian Naval Review, and then towed the Santa Maria to the St. Lawrence River, on its way to Chicago. She subsequently was made the flag-ship of the South Atlantic Squadron, and is now under process of repair.

The next cruiser to be provided for by Congress—August 3, 1886—was the BALTIMORE, built at the Cramps' ship-yard, and put in commission January 7, 1890. This ship, which had the honor of taking part in the great naval battle at Manila, has a length of three hundred and twenty-seven feet six inches, a breadth of slightly over forty-eight feet and a draught of nineteen feet six inches. Her displacement is 4413 tons, her steam power 10,064 horse, and her trial speed developed 20.096 knots per hour. Her rig comprises two military masts.

It is a fact of some present interest that the plans of the Baltimore were prepared by the English firm of the Armstrongs and offered in competition for the construction of a Spanish cruiser. Failing in this, they were purchased by the United States government, and handed over to the Cramps, who, however, made some changes in them. The outcome was the handsome and successful cruiser which now forms part of Admiral Dewey's fleet. The contract called for 9000 horse-power, but the builders showed their skill in increasing this by more than 1000 additional units of power.

The Baltimore has a protected deck of 2½-inch steel on the flat and 4-inch on the slopes, and an armament of four 8-inch and six 6-inch breech-loading rifled guns, with a secondary battery of four 6-pounder, two 3-pounder, and two 1-pounder rapid-fire guns, four

Hotchkiss and two Colt machine-guns, and one field-gun. The main battery of the Baltimore is carried eight feet higher than that of the Charleston, two of her 8-inch guns being carried upon a forecastle deck forward and two aft upon the poop. They are all sponsoned out upon the beam, and constitute a powerful battery for a ship of this class, the high freeboard enabling her to carry her guns at a very serviceable height.

The first commander of the Baltimore was Captain Winfield Scott Schley, now commodore of the flying squadron. One of her most notable services was the conveyance of the body of John Ericsson, the great inventor, to his native land. She afterwards cruised in the Mediterranean, where her graceful appearance and efficient design attracted great admiration. Proceeding thence to Chili, the attack on some of her sailors in Valparaiso almost led to war between the United States and that South American republic. During the excitement Captain Schley, fearing an attack from the Chilian squadron in Valparaiso Bay, made ready, if interfered with, to attack the ironclad Almirante Cochrane, which lay close aboard. At a later date the Baltimore became the flag-ship of the China station, and in the battle of Manila Bay suffered the most severely of the fleet from the enemy's fire, the eight wounded men of that battle being members of her crew.

In 1887 two protected cruisers were ordered, the Philadelphia and the San Francisco, the contracts calling for their completion in October, 1889, and both being put in commission in the following year. The House bill calling for the construction of these ships

provided for ten such cruisers, but the number was subsequently reduced to two.

The PHILADELPHIA was built in the city whose name she bears, at the ship-yard of William Cramp & Sons, where she was launched September 7, 1889. She was put in commission July 28, 1890, under the command of Captain Frederick Rodgers, and hoisted the flag of Rear-Admiral Bancroft Gherardi, as flag-ship of the North Atlantic squadron. She is three hundred and twenty-seven feet six inches long, forty-eight feet seven and a half inches wide, and of slightly over nineteen feet draught, her displacement being 4324 tons and horse-power 8815. On trial she developed a speed of 19.678 knots.

The protective deck of the Philadelphia is of 2½-inch steel on the flat and 4-inch on the slopes, and her armament consists of twelve 6-inch rifled cannon, four 6-pounder, four 3-pounder, and two 1-pounder rapid-fire guns, three Hotchkiss and four Gatling machine-guns, and one field-gun. Of the main battery of 6-inch guns, two are mounted on the forecastle deck, two on the poop, and four are ranged for broadside fire on each side of the gun-deck. Her guns are carried well out of the water, and when the slow-fire are replaced by rapid-fire guns, as is likely to be soon the case, she will compare favorably in fighting power with any of our cruisers of her type. On the conclusion of the Columbian Review, in which she took part, she was sent to the Pacific Station as flag-ship, and proceeded from New York to Honolulu, *via* the straits of Magellan, her journey being noteworthy as the longest run ever made by an American man-of-war on one coaling and without aid from sails. The ma-

chinery of the Philadelphia therefore holds the record for cruising economy and coal endurance over all other ships of her date and class.

The SAN FRANCISCO was built at the Union Iron-Works of the city from which she has her name, where she was launched October 26, 1889, and commissioned November 15, 1890. She is of three hundred and ten feet length, forty-nine feet two inches breadth, and about nineteen feet draught, her displacement being 4098 tons and her horse-power 9913. Her trial trip developed a speed of 19.525 knots. Her rig is that of a three-masted schooner. Her engines, like those of the Philadelphia, are of the horizontal, triple-expansion type. The armament of the San Francisco is identical with that of the Philadelphia, with the addition that she has a provision for torpedo service, being armed with four Whitehead torpedo-tubes. Her protective deck is of less strength, being of 2-inch steel on the flat and 3-inch on the slopes. She has done service as the flag-ship of the European station.

The year 1888 was somewhat prolific in orders for protected cruisers, the Cincinnati, the Olympia, and the Raleigh being provided for by the Congress of that year. Two of these, the CINCINNATI and the RALEIGH, were constructed at the government navy-yards, the former at Brooklyn and the latter at Norfolk. They are the only vessels of our new navy, with the exception of the Maine and the Texas, which were built by the government for itself, all others having been put out under contract in the large private ship-yards of the country.

These vessels are identical in size and power, being three hundred feet long, forty-two feet wide, and


MAP OF THE
PHILIPPINE
ISLANDS
SCALE OF MILES
0 50 100 200
CHINA
Fuchau
Amoy
Canton
Swatow
Hongkong
FORMOSA STRAIT
FORMOSA
Kelung
Tamsui
Chokeday
Potao
Danau
Tai-wan
Ta-kau
Pelam
South Cape
Bashee Channel
BASHEE IS.
BATAN IS.
HAINAN ISLAND
Balintang Channel
CALAYAN I.
CLARO BABUYAN
DALUPIRI I.
BABUYAN IS.
CAMIGUIN I.
Pt. Pata
C. Bojeador
Pt. Engano
Laoag
Aparri
Tugueaboa
Vigan
Camarag
LUZON
Divinisa Pt.
Lingayen Gulf
Sa. Fernando
Pt. Tumango
C. Bolinao
Lingayen
C. San Ildefonso
Iba
Bongabong
Bacolor
Balanga
POLILLO I.
PHILIPPINE ISLANDS
Subig Bay
MANILA
S. Miguel Bay
CORREGIDOR I.
Cavite
Manila Bay
Balayan
Daet
Caceres
CATANDUANES I.
LUBAN I.
Batangas
Albay
Bernardino Strait
Calapau
MINDORO I.
BURIAS I.
TABLAS I.
TICAO I.
Palapa
Mangarin
Mindoro Strait
Pt. Mendoe
Cabalogan
CALAMIANES ISLANDS
MASBATE I.
SAMAR I.
LINCAPAN I.
Pandan
BILIRAN I.
Batan
Tacloban
Cabull Pt.
Cook Ch.
PANAY I.
Surigao Str.
Taitay
GUYO I.
S. Jose
Iloilo
ZEBU I.
DINIGAT I.
PALAWAN OR PARAGUA ISLAND
DUMARAN I.
Naso Pt.
GUIMARA I.
Jagna
Bahia Honda
Jimamailan
NEGROS I.
BOHOL I.
Surigao
Dumaguite
FUEDOS I.
Butuan
Island Bay
Dapitan
Iligan B.
Cagayan
Buliluyan Pt.
S. Antonio Bay
Sindangan Bay
Bislig
BALABAC I.
SULU OR MINDORO SEA
Misamis
Balabac Strait
Balangonan Pt.
S. Maria
MINDANAO
BALAMBANGAN I.
Baganga
Sampanmangio Pt.
BANGUEY I.
Zamboanga
Mindanao
Davao
Maruda
BASILAN I.
Abai
Labuk Bay
Amboug
SULU I.
SULU ARCHIPELAGO
Davao B.
Pujaga B.
C. S. Augustin
Yangout Pt.
Elopura
TAWEE-TAWEE I.
Serangani B.
C. Usang
Brunei
Giong (Darvel) Bay
Biutulu
Telokipil
CELEBES SEA
C. Sirik
Bulungan
TOULOUR IS.
BORNEO
North C.
Rejaug
Sambilioen
C. Kandie
Lonbok Bay
C. Kaniogan
Strait of Macassar
CELEBES I.
Molucca Passage
G. of Tomini
Bormay & Co., N.Y.
115
120
125
25
20
15
10
5

eighteen feet draught. Their displacement is 3213 tons, and their horse-power estimated at 10,000. Their speed has not been developed on trial, but is estimated at nineteen knots per hour. They were launched in 1892, and commissioned in 1894, and are nearly identical in protection and armament; their decks being of 1-inch steel on the flat and 2½-inch on the slopes; their main armament consisting of one 6-inch slow-fire and ten 5-inch rapid-fire guns. The secondary armament of the Cincinnati comprises eight 6-pounder and two 1-pounder rapid-fire guns, two Colt machine-guns, one field-gun, and two Whitehead torpedo-tubes. The Raleigh carries two more 1-pounders, and is provided with Gatling instead of Colt machine-guns.

The OLYMPIA, the third of the three ships named, has won special honor, as bearing the pennant of Commodore Dewey in his great victory in the Philippines. This ship is of western origin, having been built at the Union Iron-Works of San Francisco. Her keel was laid in June, 1891, she was launched November 5 of the following year, and received her first commission on February 5, 1895.

The Olympia is rigged as a two-masted schooner, and is three hundred and forty feet long, fifty-three feet wide, and twenty-one feet six inches in draught. She has a displacement of 5870 tons, her engines can develop 17,313 horse-power, and her record of speed is 21.686 knots. This fine vessel has been complimented as being a smaller edition of the New York, to which she does, indeed, present a certain resemblance in general attractiveness of aspect and in some other particulars, though she differs in type, her protection being confined to that derived from an armored

deck of 2-inch steel on the flat and 4¾-inch on its sloping sides. This replaces in considerable measure internally the protection given by an external armor-belt. A layer of cocoa packing, as in the case of the two other ships just named, affords protection against the inrush of water.

It may safely be said that there is no other protected cruiser in our navy, nor in any other navy, that surpasses the Olympia in those qualities that go to constitute perfection in a ship of her class and size. Her speed is as great as can well be had without the sacrifice of some other feature of essential value, such as protection or weight of guns. The Columbia and Minneapolis are her superiors in speed, but have attained this supremacy only through a considerable reduction of their powers of offence. They can run faster than the Olympia, but cannot fight as well. If she be compared with the British ships of the Eclipse type, of practically the same displacement, she will be found, while carrying a considerably superior weight of guns, and a heavier deck armor, to have also the advantage of over two knots in speed,—this due to her greater engine power, which is nearly double that of the British ship.

The armament of the Olympia is very heavy for a cruiser of her weight. It comprises in its main battery four 8-inch breech-loading rifles, which are mounted in barbette turrets, the barbettes and turrets having respectively 4½- and 3½-inch steel armor. To these heavy guns is added a broadside battery of ten 5-inch rapid-fire guns, while the secondary battery embraces fourteen 6-pounder and seven 1-pounder rapid-fire and four Gatling guns and one field-gun.

The provision for torpedo service is exceptionally heavy, there being no less than six tubes designed for Whitehead torpedoes.

The 5-inch guns are ranged in sponsons along the deck from bow to stern, protected by four inches of Harveyized steel armor, and so placed that they can give a direct bow or stern fire from four and a broadside discharge on either side from five guns. The 8-inch guns stand at a height of twenty-two feet above water level, and can be trained through an arc of 208 degrees. The fourteen 6-pounder guns are ranged for broadside fire around the decks, and the smaller guns on the bridge and the fighting-tops of the masts.

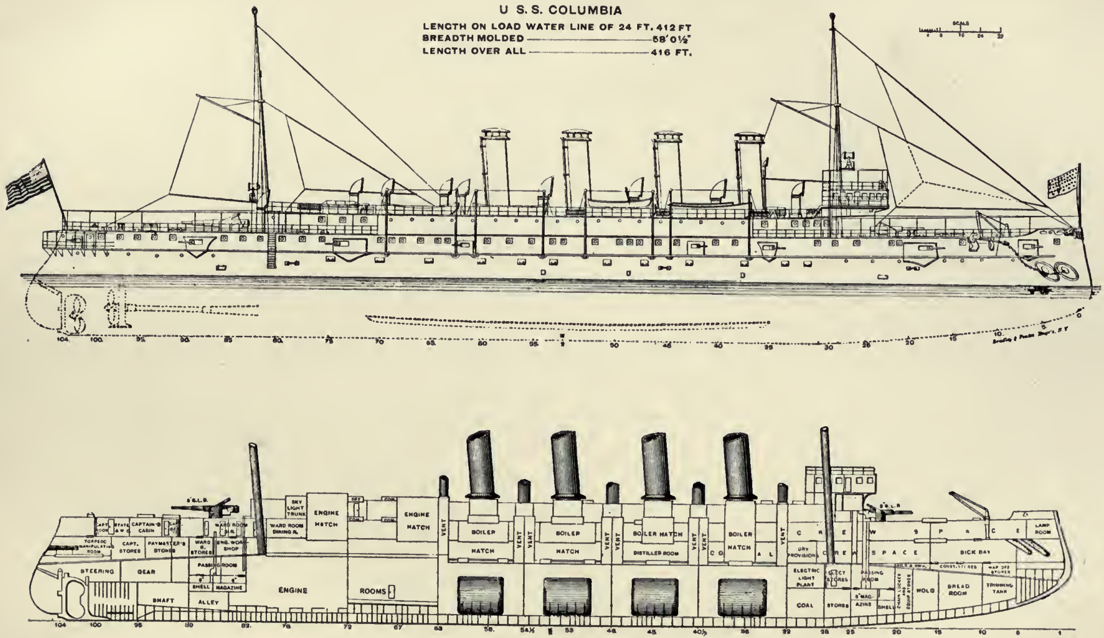
The Olympia had the good fortune of serving as flag-ship of the Asiatic squadron on the outbreak of the war with Spain and of flying Commodore Dewey's pennant during his rapid run from Hong Kong to Manila Harbor in the Philippines. In the terrific stream of fire poured from the American ships on the Spanish fleet the large and effective battery of the Olympia took the foremost part, and the rapid and complete demolition of the fleet of Spain was due in great measure to the driving hail of shot and shell poured in a ceaseless torrent from her guns. Few ships with less endurance than a battle-ship could have stood long against that tempest of fire, and the Olympia thoroughly demonstrated the powers of destruction possessed by modern artillery when handled by trained and skilful gunners.

There remain to be described two of the finest of our protected cruisers, the remarkably swift Columbia and Minneapolis, ships with few or no equals of their class in the world as regards power of cutting

their way with phenomenal rapidity through the ocean waves. Speed was their leading purpose, and this they attained, at some sacrifice of weight in guns and armor. But the latter requisites are of secondary importance, as these ships were built to act as commerce destroyers, and were expected to trust to fleetness of foot in avoiding dangerous enemies. They could play around any vessel of superior strength in the navies of the world, and show their heels at will.

The COLUMBIA, officially known as "Cruiser No. 12," was authorized by Act of Congress June 30, 1890, at the same date with the battle-ships of the Indiana class, and was built at the ship-yard of the Cramps, where she was launched July 26, 1892. She was first put in commission April 23, 1894, under command of Captain George W. Sumner. For several years prior to her building the great desideratum of naval architects had been to combine high speed with large coal endurance in unarmored or protected cruisers. This was held in view in building the Baltimore, the Olympia, and several other vessels, but none of these were large enough to carry a weight in coal sufficient for the extraordinary endurance desired. In the construction of the Columbia both these requisites were kept in view, and a cruiser was ordered of much larger size than any previously built, and of engine-power superior to that of any of our vessels then afloat.

The contract for the Columbia called for a vessel of about seven thousand tons displacement and twenty-one knots speed, to cost, exclusive of armament, not more than $2,750,000. The actual cost of construction was $2,725,000, for which sum her skilful builders produced a vessel of 7375 tons displacement, and with



SHEER ELEVATION AND LONGITUDINAL SECTION OF THE COLUMBIA.

a speed reaching on trial-trip the remarkable level of 22.8 knots per hour. In parts of her course, indeed, she attained a speed of over twenty-five knots. Of course, the trial-trip speed of a ship does not indicate her ordinary performance, which is considerably slower, but the speed of all war-vessels is rated upon the record thus made.

In making this rare performance the Columbia was driven through the water by engines of 18,509 horse-power, moving triple screws, she and her successor, the Minneapolis, being the only ships in our navy with this threefold distribution of power. The three screws of the Columbia are driven by three triple-expansion engines, each in a separate water-tight compartment, one of the screws being in the centre line of the ship, above the rudder, and the other two under the opposite counters, as in twin-screw vessels.

This triple-screw method of moving a vessel was in 1890 an experiment. The French had tried it in a steam-launch, the Carpe, and with such success as to induce them to order a large cruiser built on this system. The Italians had tried it in a torpedo-boat in 1886, but had afterwards taken out the centre screw. Thus when George W. Melville, engineer-in-chief of the navy, decided on equipping the Columbia with this device, it had never been tried on a large scale, and its effect remained to be proved. Yet he believed that it would be of advantage, in the case of high engine power, in dividing the work, and reducing the strain on each shaft. If two screws had been used, over nine thousand horse-power would have had to pass through each. By using three, each carried but about six thousand horse-power, and the danger of a break-

down was much decreased. In ordinary cruising only the central screw is used, this giving a speed of fifteen knots. When the two side screws are used alone seventeen to nineteen knots can be maintained. With all three screws the high trial speed becomes possible.

Some of her critics maintained that the trial speed of the Columbia was not a true indication of her powers, and that a continuous high speed could not be had out of her engines. The builders and the Navy Department denied this, and eventually, to settle the controversy, the Secretary of the Navy ordered her to cross the Atlantic, from Southampton to New York, at full speed. The start was made on Friday, July 26, 1895, and Sandy Hook was reached on the following Friday, the run of three thousand and ninety knots having been made in six days, twenty-three hours, and forty-nine minutes, the mean rate of speed being 18.41 knots per hour, and the daily coal consumption two hundred and twelve tons. Natural draught was used throughout the trip. No other cruiser has ever made even a remote approach to this performance.

The coal capacity of the Columbia on her normal displacement is twelve hundred tons, but by filling her bunkers and stowing on her protective deck two thousand two hundred tons can be carried, sufficient to give her a cruising limit of sixteen thousand knots. The protective deck, covering the ship near her water-line from stem to stern and guarding her vital parts from injury, is of 2½-inch nickel steel on the flat and 4-inch on the slopes over the engine-rooms, the sloping sides extending downward to several feet below the water-line. The conning-tower is built of 5-inch steel.

The Columbia and the Minneapolis are the longest vessels in our navy, and comparatively among the narrowest, they presenting that slender aspect necessary for high speed. Their load-line length is four hundred and twelve feet, their breadth slightly over fifty-eight feet, and their draught twenty-two and a half feet. They have a two-masted-schooner rig, four low smoke-stacks rising in a row between the masts of the Columbia, while the Minneapolis is content with two, of larger diameter.

The armament of these ships is light for vessels of their size. It consists of one 8-inch and two 6-inch slow-fire and eight 4-inch rapid-fire guns, with a secondary battery of twelve 6-pounder and four 1-pounder rapid-fire guns, two Colt machine-guns, and one field-gun. Each also has four Whitehead torpedo-tubes.

The Columbia was selected to accompany the New York in the naval demonstration at Kiel, on the opening of the Baltic Ship Canal, and, next to her consort, was the vessel of the fleet that attracted most attention. It was after this demonstration that she made her phenomenal run across the Atlantic. During the war with Spain she was placed on duty in patrolling the coast, in view of threats of an attack on our coast cities by Spanish cruisers, and on the evening of May 28, 1898, while moving along near Fire Island Light, off New York harbor, in a dense fog, was run into by the British steamship Foscolio, the two vessels coming together with a terrific crash, the prow of the Foscolio making an immense rent in the cruiser's side. The British ship fared the worse, her whole bow being torn off, so that, despite her water-tight compartments, she

filled and sank in a few hours. The rent in the starboard side of the Columbia was over six feet wide, and extended from near the upper deck to five feet below the water-line, the 4-inch thick protective deck being bent back nearly double by the force of the blow. Only for this guard of steel and her heavy timbers, the cruiser would probably have been cut in two. As it was, her water-tight compartments, more than two hundred in number, kept her easily afloat, and a short period in dry dock was all that was necessary to put her in order for service again.

The MINNEAPOLIS is looked upon as a sister ship of the Columbia, the chief difference in construction being the use of two large smoke-stacks in place of the four smaller ones of the Columbia. She was authorized a year later, March 2, 1891, and was completed and put in commission December 13, 1894. She, like the former, was built by the Cramps, at Philadelphia, under a contract price of $2,690,000. While of the same size and displacement as her sister ship, the Minneapolis is of higher engine power, her three engines giving her a maximum of 20,862 horse-power, the greatest of any vessel in our navy, while she exceeds all others in speed, her trial trip showing a mean rate of 23.073 knots through a run of eighty-eight miles. In the words of her builders, "Viewed as a whole, this performance makes the Minneapolis the queen of protected cruisers, and places the commercial fleets of the world without exception at her mercy."

There is one further protected cruiser in our navy, the NEW ORLEANS, formerly the Amazonas, built for Brazil by the Armstrong Company, of Newcastle, England, and purchased by the United States in 1898,

in anticipation of war with Spain. A sister ship, to be known as the Albany, was also purchased, but was not completed at the outbreak of the war, and therefore could not be obtained from her builders until after the close of the conflict.

The New Orleans is three hundred and thirty feet long, forty-three feet nine inches wide, and of sixteen feet ten inches draught, her displacement 3600 tons, her horse-power 7500, and her speed 21.05 knots. She is protected by a Harveyized steel deck of 3-inch thickness on its curving sides. This ship carries a powerful armament for a vessel of her size, her main battery comprising six 6-inch and four 4.7-inch rapid-fire guns, and her secondary battery ten 6-pounder and four 1-pounder rapid-fire guns, and four machine-guns. She has in addition three torpedo-tubes. The guns of the New Orleans are of the latest pattern, and have much greater power for their size than guns made four or five years ago; they are provided with improved breech mechanism, which adds to the rapidity of their fire.

The 6-inch guns, for example, are fifty feet in length, about a third longer than was attempted for guns of this dimension a few years ago. Increased length in a gun adds to the velocity with which the projectile is driven from the muzzle, since it gives longer time for the gases from the powder to act. By such an increase in length, the power of larger guns can be attained by those of smaller diameter. As compared, for instance, with the Intrepid, a British cruiser built in 1892, the following improvement in gun-power is shown. The 6-inch guns of the New Orleans have a muzzle energy of 4840 foot-tons, those

of the Intrepid 3356 foot-tons. An equal or increased difference is shown in the smaller guns of the two vessels, indicating an immense advance in gun performance in the past few years.

Another purchased cruiser is the TOPEKA, bought from an English firm of naval builders. She is little more than a heavy armored gunboat, being of only 1800 tons displacement. Her speed record is sixteen knots, and she carries a battery of considerable strength, including two 6-inch rifles and six 5-inch rapid-fire guns. Her light draught adapts her for river work.

The unprotected cruisers of the United States are three in number, the DETROIT, the MARBLEHEAD, and the MONTGOMERY, all authorized in 1888 and completed in 1893 and 1894. They are sister ships, two hundred and fifty-seven feet long, thirty-seven feet wide, and of fourteen feet seven inches draught; their displacement 2089 tons, horse-power over 5000, and respective speeds 18.71, 18.44, and 19.05 knots per hour. They have a thin protective and water-tight deck of $\frac{5}{16}$-inch steel on flat and $\frac{7}{16}$-inch on slopes. Their armament consists of ten 5-inch, six 6-pounder, and two 1-pounder rapid-fire guns, two machine-guns, one field-gun, and two torpedo-tubes.

These vessels rely for protection upon their cellulose packing and coal-bunkers, their thin water-tight plating, and their numerous compartments. While the shot of an enemy may easily pierce the sides or the deck, a dangerous inflow of water is likely to be prevented by these protective devices. The vessel may be pierced even below the load-line without flooding the compartments containing the engines,

boilers, and magazines. These boats are provided with very roomy accommodations for officers and crew, they being mainly intended for long cruises on distant stations.

CHAPTER VII.

RAMS, GUNBOATS, AND TORPEDO-BOATS.

THE ram, an instrument of warfare which has done little harm to vessels of war except as the result of accident, has been paid considerable attention to in American warfare, particularly during the Civil War. In the old days of wooden ships little or no use was made of this method of doing injury, the danger to the attacking vessel being about equal to that of the vessel assailed. We have an illustration of this in the recent ramming of the Columbia by a British merchant steamer. The cruiser had a gaping wound torn in her side, but the Foscolio was sent to the bottom. This accident, however, serves to show the terrific power which may be developed by the ram. Every effort was made to check the speed of the Foscolio and the two vessels little more than drifted together. Had the Foscolio, on the contrary, been provided with a ram bow, and driven at speed against the cruiser's side, the latter would undoubtedly have been cut through and wounded beyond hope.

While iron armor protects the upper sides of vessels, they remain vulnerable below, and it is evident that if they could be struck a hard blow under water

it would be of more immediate disastrous effect than all the shot and shell that can be poured upon them from above. Ram bows were, therefore, added to many of our vessels during the Civil War, and some river craft were sunk by their aid, though no great service was done.

In foreign navies the injury done by the ram has mainly been the result of accident. The British vessel Vanguard was in this way sunk off the Irish coast by the Iron Duke, and the German Grosser Kurfürst off Folkestone by a companion vessel. In 1893 the British ship Camperdown ran into and sunk the Victoria in the Mediterranean, with all her crew. In war, however, the ram has proved singularly inefficient. In the war between Chili and Peru, in 1879, the Huascar attempted to ram the Esmeralda, a vessel which lay disabled and motionless before her. Three attempts were made before success was attained. In a later action two Chilian ironclads made several attempts to ram the Huascar, but failed. At the battle of Lissa, between the Austrian and Italian fleets, many efforts were made to ram, yet only one succeeded, and that only through an injury to the rudder of the vessel sunk. In recent warfare the ram has become still more useless, battles being fought at a greater distance than of old, while in case of a near approach the torpedo-tube can be trusted as a safer and more efficient weapon of attack.

Only two vessels have been built expressly as rams, the British Polyphemus and the American Katahdin, neither of which has had an opportunity to demonstrate its powers. The Polyphemus was begun in 1878 and completed in 1882. It is a low-hulled vessel,

the exposed portion being like a turtle's back, and covered with thin armor to deflect any projectile that may strike it. It carries only a few light guns, and possesses high speed, a powerful ram, and a torpedo equipment. This vessel is of 2500 tons displacement and eighteen knots speed.

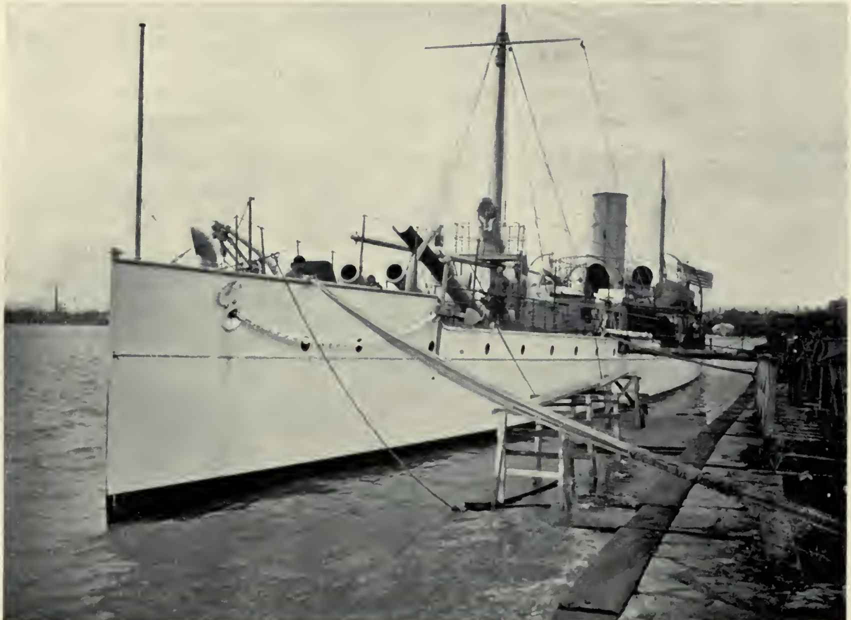
The KATAHDIN, a similar vessel in the American navy, was ordered in 1889 and commissioned in 1896. It is of 2155 tons displacement and 16.11 knots speed, is two hundred and fifty-one feet long, forty-three feet five inches wide, and sits very low in the water, the height above the water-line being six feet. The lower portion of the hull is dish-shaped, the upper part curved, the curve beginning six inches below the water-line. This upper portion is armor-plated, the thickness tapering from six inches at the water-line to two inches at the crown of the deck. Above the deck stand a conning-tower, a smoke-stack and ventilators, and two light barbettes carrying 6-pounder guns. The ram is of cast steel, about fourteen tons in weight, and so braced that the force of the blow will be distributed throughout the whole vessel, while the deck projects over the hull in a knife-edge that would cut deeply into any ship assailed. No vessel ever built could withstand a blow from this ramming machine could she have an opportunity to fling her two thousand tons of steel and iron against its sides at a speed of over eighteen miles an hour. But that she will ever have an opportunity to display her prowess in war is exceedingly problematical.

The United States navy possesses another vessel of unique design which promises to be more serviceable in action than the Katahdin, its destructive powers

being in the direction of those of the torpedo-boats. This is the dynamite gunboat VESUVIUS, built for the utilization of the dynamite gun, a weapon developed by Lieutenant Zalinski, whose powers have been proved on land, but await an opportunity to be demonstrated at sea. This boat, authorized in 1886, and built by the Cramps, was first commissioned on June 7, 1890, and is at present with Admiral Sampson's fleet, her great speed rendering her useful as a despatch-boat, while she awaits an opportunity to show the powers of her peculiar weapon of assault.

The Vesuvius is a long, low, narrow vessel, with a bow like a knife-blade. She is of but 929 tons displacement, but has engines of 3795 horse-power and a speed of 21.42 knots per hour. From the deck near her bow project, at an angle of elevation of 18 degrees, three thin iron tubes, the greater part of whose fifty-four feet of length lies below the deck. They are of fifteen inches diameter. The shell which these guns are designed to throw is charged with dynamite, and that this dangerous substance may not be exploded in the gun by the shock of a powder discharge, compressed air is used at a pressure of one thousand pounds to the square inch. The firing tubes are made of thin cast iron, the pressure on them being light. They are capable of throwing a 250-pound charge of dynamite a distance of a mile and a half.

The shell for this gun is fourteen and three-quarters inches in diameter and about seven feet in length. It is fitted at its rear with spiral vanes, whose rotation serves to guide its flight through the air. Ten of these projectiles are provided for each gun, making a complement of thirty in all. The tube is fixed in position



DYNAMITE CRUISER VESUVIUS.

and the aiming depends upon the movement of the vessel, the officer in the conning-tower having the ship and her guns under his control and training the ship instead of the gun upon the foe. Practically the whole vessel acts the part of a floating carriage for her guns.

The dynamite cartridge as yet has been tried only in experiment. It has been proved that the gun can be fired in safety, and its projectile thrown with a fair degree of accuracy. In government trials an old schooner, moored at a mile distance, was completely wrecked by fifty-pound charges thrown from an 8-inch gun. It is believed that a shell from the Vesuvius, exploding under water, would destroy a ship twenty or more feet away, but a dread exists that it might explode in the gun, and produce its effect on the Vesuvius herself.

A second dynamite boat has come into the possession of the government in the purchase of the Nictheroy, now the Buffalo, from the Brazilian government. This boat was armed with a dynamite gun in the recent Brazilian war, though it will probably be used as an ordinary gunboat in its present service.

The Dolphin, a steel despatch-boat, built in 1883 at the John Roach yard, Chester, Pennsylvania, is of two hundred and forty feet length and thirty-two feet breadth, driven by a single-screw engine of 2253 horse-power, and capable of a speed of 15.5 knots. She formed part of Admiral Sampson's fleet in the war with Spain, carrying an armament of two 4-inch and two 6-pounder rapid-fire guns, with two Hotchkiss and two Gatling machine-guns.

At the opening of the year 1898 the United States possessed sixteen gunboats. These have been added

to with considerable rapidity, by the purchase and conversion of yachts and other suitable craft, until the fleet of these serviceable craft has been much increased. This "mosquito fleet," as it is irreverently termed, was very usefully employed during the war with Spain in blockading the Cuban ports, releasing the great ships of war for duty in more important fields. The largest of our gunboats are the YORKTOWN, the BENNINGTON, the CONCORD, and the MACHIAS, the first three of 1710, the last of 1777 tons displacement. These have speeds of 15.5 to 17.5 knots, have thin water-tight steel decks, and carry six 6-inch rifled guns, with the exception of the Machias, whose main armament consists of eight 4-inch rapid-fire guns. Three others of later date (1893), the HELENA, the NASHVILLE, and the WILMINGTON, are of lighter weight and less draught, the sister ships Helena and Wilmington drawing but nine feet of water, and the Nashville eleven. The light draught of the Helena and her consort is due to the fact that they were constructed with a view to service on the rivers of China. They are about two hundred and fifty feet long and forty feet beam, these dimensions, in common with their nine feet draught, being given in view of their proposed river service. They each carry a military mast, well provided with firing-tops, and have elevated conning-towers.

A Japanese officer suggested that the banks of the Yellow River of China were so high that they could not be seen over except from a considerable elevation, and in response to this hint the boats in question were supplied with a curious combination of conning-tower and military mast. This mast is double, con-

sisting of an outer iron tube of six feet and an inner one of two feet diameter. Between them ascends a spiral staircase, running to the conning-tower, which is built under and partly supports the lower top. The tower, nearly fifty feet high, stands out from the mast, and contains all necessary appliances for steering and controlling the ship, while windows with small openings give an outlook over the surrounding country. The fighting-top above is of fourteen feet diameter, and above it is an electric-light top and a second fighting-top of six feet diameter. These boats carry eight 4-inch rapid-fire guns and a secondary battery of four 6-pounder and two 1-pounder rapid-fire and two Colt machine-guns, with a field-gun for use by landing parties.

The remaining gunboats existing previous to 1898 include the BANCROFT, the CASTINE, and the PETREL, the last named the smallest of all, its displacement being 892 tons. There are six others of a different construction, being what are known as composite gunboats. The ordinary iron or steel war-ship has one constant source of trouble, the accumulation of barnacles and marine vegetation, which gather thickly on their bottoms, checking their speed and demanding frequent docking, with its cost and loss of time. The composite gunboat is designed to overcome this trouble, by the use of wooden planking to form the under-water hull. On this a sheathing of copper is placed, since the marine animals and plants avoid this metal. If greater strength is required, there may be an inner sheathing of steel, the whole being joined together by composition bolts to prevent galvanic action. Vessels of this class will be of great utility

in stations remote from docks, such as the Alaskan rivers and seas.

These boats were authorized in 1895, four of them, the ANNAPOLIS, NEWPORT, PRINCETON, and VICKSBURG, having full sail power in addition to their single screw; the two others, the MARIETTA and the WHEELING, having twin screws driven by about the same power, and carrying canvas enough only to steady them in a sea-way. They carry only rapid-fire guns, each being armed with six 4-inch, four 6-pounder, and two 1-pounder guns of this character, a Colt machine-gun, and a field-gun.

The gunboats are especially adapted for service on inland waters, alike of home and foreign stations. Their defensive power is small, their only armor being a light protective deck, while even this is omitted in the composite boats. They have good offensive powers, however, their batteries, while of small caliber, being of high power. Their speed varies from twelve to over seventeen knots, while their light draught enables them to cruise in waters which heavier vessels cannot enter, and provides a means of escape when chased by heavier craft. Nine of these vessels have been built since 1893, foreshadowing, as some think, a more active foreign policy, as ships of this class are likely to be of special service in such foreign stations as the Asiatic, where rivers too shallow for even our smallest cruisers may need to be ascended. With the fleet added in 1898 by purchase, the United States navy is now fairly well provided with vessels of this class.

There is another type of war-vessels, specially modern, now to be named, the torpedo-boat, a class

of swift, inconspicuous, daring, and threatening vessels which have become the unceasing dread of naval officers,—less from their actual performance than from their frightful possibilities. The use of the torpedo in warfare, though of much earlier origin, was first fairly inaugurated in the American Civil War, developing into the torpedo-boat in the closing years of this conflict. The Housatonic and the Albemarle were its victims in this war, each side losing one vessel through an attack by this dreaded foe.

These early boats carried their torpedoes at the end of a spar, the torpedo exploding by contact. The danger to the assailant in an attack by such a vessel set the brains of inventors to work, and there were finally evolved several kinds of self-moving torpedoes, which could be put in motion at a distance from a hostile ship and be depended upon to go straight to their mark. A description of these "automobile" torpedoes must be left for a later chapter, the torpedo-boat being all that we are concerned with here.

The few performances with torpedo-boats during the Civil War set all European naval authorities to thinking, and while the United States rested content with the lesson it had taught, the nations beyond the Atlantic were busily engaged in developing this new species of war-craft. What was needed was a boat of great speed, almost noiseless in movement, and so low in the water and dull in color as to be nearly invisible, the purpose being to approach near enough unseen to discharge a torpedo with effect and then glide hastily and swiftly away. By 1877 the torpedo-boat had grown to a craft of from eighty-five to one hundred feet in length and had gained a speed of from eighteen

to twenty-one knots, their engines being of high power for vessels of their size.

Then arose a new idea. Before the torpedo-boat had succeeded in doing any of the work of destruction for which it was designed, it became itself an object for destruction, and a series of larger and swifter boats came into existence, under the title of torpedo-boat destroyers, or simply destroyers, with the double mission of running down and destroying the torpedo-boats of an enemy, or on occasion serving as torpedo-boats themselves.

The idea of building destroyers ("torpedo-boat catchers" they were first called) arose in England in 1885, it being proposed to give them about twenty knots of speed. These were ill-named, as many then existing torpedo-boats could outstrip them, and attention was soon paid to increasing their speed, engines of enormous power for such small boats being gradually introduced. The Ariete, built by Thornycroft in 1887 for the Spanish navy, reached the then astonishing speed of twenty-six knots. The Daring, built by the same builder for the British navy in 1893, showed a speed of twenty-nine knots, and in 1895 the Sokol, built in England for the Russian government, surpassed the thirty-knot mark. The later British torpedo-boat destroyer Desperate is credited with 30.5 knots, and the Turbinia, built at the Thornycroft yard in 1897, is said to have attained the extraordinary speed of thirty-four knots. In this boat the recently invented steam-turbine is used, in which the impact of steam upon the face of vans turns the screw-shaft, instead of steam-pressure being employed, as in ordinary engines. The Turbinia is too light and small to

be of service in war, but a larger boat has been ordered in which the steam-turbine and the three propellers of this little racer are to be reproduced.

The United States was slow in taking part in this competition, so actively pursued abroad, only one torpedo-boat, the Cushing, being ordered before 1890, in which year it came into service. A second, the Ericsson, was authorized in 1891, and then the government rested until 1894. Since then it has shown activity in this direction, twenty-two of these boats having been authorized prior to July 1, 1897. The speed of these boats increased from the Cushing, of 22.5 knots, successively to 24.5 in the Rodgers, the Winslow, and the Foote, and 28.6 in the Porter, while of those not yet in service several are estimated at 30 and 30.5 knots. The largest ordered is the Stringham, two hundred and twenty-five feet long, twenty-two feet wide, and six feet six inches draught, with 340 tons displacement, an estimated power of 7200 horse, and an estimated speed of thirty knots.

The exigencies of the year 1898 caused the ordering of a large number of these boats, some of them bearing the title of torpedo-boats, one of their requisites being that they should make a high speed in a moderate sea-way, while to sixteen of them has been given the composite title of "destroyers of torpedo-boat destroyers," these being required to make a high speed in a heavy sea-way. These titles indicate a remarkable development in this direction. First came the torpedo, then the torpedo-boat, then the torpedo-boat destroyer, and now we have the destroyer of the destroyer. It is not easy to say where this curious line of evolution will end, or even when the ulti-

mate of speed will be attained, though it will scarcely be possible to use a higher horse-power in a vessel of this size or drive any boat much more rapidly through the waves.

The evolution of the torpedo-boat has found its counterpart in the development of the search-light and the rapid-fire gun, the former constantly flinging its powerful ray over the waters in any imperilled locality, and the latter pouring such a stream of balls upon any detected torpedo-boat that its only safety from sudden doom lies in instant flight. As a result this dreaded instrument of war has been largely disarmed, and the torpedo-boat has not yet been able to repay in results the labor bestowed upon it.

Meanwhile, the use of the torpedo-tube has widely extended. All our battle-ships are provided with tubes, from two to four in number, for the discharge of these dangerous projectiles, the same is the case with many of the cruisers, and one of our gunboats, the Bancroft, is similarly provided. They seem much less likely to be of use in these vessels than in those built expressly to carry them, and up to the present time the torpedo, as a missile of war, can hardly be said to have justified its existence.

A brief description of some of our torpedo-boats comes here properly into play. One of the earliest of these went to a muddy grave in common with the Maine in Havana harbor. This was a little craft, about sixty feet long by nine feet beam, which was carried on the deck of the Maine ready to be launched when occasion demanded. With a full supply of coal and stores it weighed only fifteen tons, its sides being made of very thin steel. Its bows carried a torpedo-

tube adapted to the Whitehead torpedo, while on its after-deck was a 1-pounder rapid-fire gun. Whatever possibilities for mischief there might have been in this diminutive craft were never developed, the mine which wrecked the Maine ending the existence of her deck-borne consort at the same time.

The Porter, one of the torpedo-boats of Admiral Sampson's fleet in Cuban waters, first commissioned in February, 1897, is a craft of 190 tons burden and 4000 horse-power. Her trial speed was 28.63 knots, a rate of motion equivalent to about thirty-three miles an hour. When this boat is driven at top speed her stern settles and her bow lifts, until the keel is visible above the water for five or six feet back from the stem. This is a common occurrence with light-draught boats when driven at high speed. The Porter carries three torpedo-tubes, one on each side and a third at the stern, while four 1-pounder rapid-fire guns complete her armament.

In these boats the torpedo-tube or gun stands exposed on the deck, pivoted so that it may be trained on the mark before firing. No attempt is made to protect the hulls by armor. They are of the lightest construction, none of their plates being over one-fourth of an inch thick. Their sole trust is in their speed and the covert character of their attack.

The torpedo-boat delivers its attack at night and by stealth. Pains are taken to suppress all sparks from the smoke-stacks. No lights are shown anywhere. The little vessel is painted as near the color of the sea as available, to avoid detection. If possible, she comes within an eighth of a mile of her enemy before launching a torpedo, and then darts away in a hurry.

In anticipation of such an attempt a big war-vessel at night, when at anchor, employs powerful search-lights in her lookout. Defence by means of wire netting stretched around the ship is no longer attempted. The device is not proof against torpedoes.

When within range the little craft swings to port or starboard and launches a death-dealing missile upon the foe. In case of failure the stern tube can send another of these messengers of destruction. The work of the torpedo-boat is that of the forlorn hope. If discovered at her work she is sure to be greeted with a rain of bullets and shells that will pierce her thin sides as if made of paper, and her crew take their lives in their hands when they set forth upon their errand of death.

The torpedo-boat destroyer has a somewhat different mission. Her duty is a double one, to attack an enemy's ship when opportunity serves, and primarily to assail the torpedo-boats of the foe, trusting for success to her greater weight and speed. For this purpose she is adapted to discharge a projectile in advance, as she chases an adversary through the waves. Of boats of this class in our navy may be named the Bailey, a craft authorized in 1897, two hundred and five feet long, nineteen feet wide, and of six feet draught. She is of 235 tons displacement, her power being estimated at 5600 horse, and her speed at thirty knots, though a higher speed may be developed. Her two 18-inch torpedo-tubes are supplemented by four 6-pounder rapid-fire guns. Of these guns, two are mounted on the main deck and two on the forward and aft conning-towers, the latter having nearly an all-round fire.

TORPEDO-BOAT PORTER.

A distinguishing characteristic of these boats is their immense power as compared with their size. The engines of the Bailey, with her 235 tons displacement, will have more than half the power of some ocean packets of 8000 tons. The Stringham, of 7200 horse-power, will make a still nearer approach. Speed is the one essential requisite, and everything else is subordinated to this. The crew, about thirty in number, will be obliged to accommodate themselves in a contracted space, the four cylinder triple-expansion engines, four boilers, and two fire-rooms taking up a lion's share of the under-deck room, while a large share of space must be given to the coal, of which sufficient will be provided to enable the Bailey, when not driven at full speed, to steam 3000 knots.

At the approach of war with Spain it quickly became evident that a larger fleet might be needed, and active efforts were made to add to our navy by purchase, four cruisers and two torpedo-boats being purchased abroad, while a considerable number of vessels were obtained at home to serve as an auxiliary fleet. Those include colliers, yachts converted into gunboats, tugs utilized as scout-boats, and a variety of larger craft which were quickly adapted as cruisers. Chief among these are the four great Atlantic steamers of the International Navigation Company's line, the St. Louis, St. Paul, Paris, and New York. Of these the former two, built at Philadelphia by the Cramps, retain their names, while the Paris and the New York, of foreign build, are now known respectively as the Yale and the Harvard. These great steamships have few rivals in size and speed upon the ocean waters, their

tonnage equalling that of our largest battle-ships and their speed ranging from twenty to twenty-one knots. Though not armored, and unfit to fight any battle-ship or strong cruiser, as ocean scouts they are invaluable, while their powers of offence are not to be despised, the first two named having batteries of twelve 6-inch rapid-fire guns, and the last two an equal number of 5-inch guns.

To these must be added four other Atlantic passenger steamers, renamed the Yankee, Prairie, Dixie, and Yosemite, of 4660 tons and fourteen knots of speed, their armament being six 6-pounder rapid-fire guns. Other subsidized vessels have been adapted to special purposes. For instance, the Illinois, of the American line, has been converted into a refrigerator vessel, and two other vessels, the Juniata and the Niagara, are now utilized as repair ships, an important service to which others will be adapted.

The repair ship seems to be a new idea, a product of the universal American genius. Though armed sufficiently for self-defence, these vessels have no mission of offence, their purpose being to attend a fleet, and, in case of injury of minor character during an engagement, to make repairs upon the spot. These may often be completed in time to allow the wounded ship to return to the fight, or if the hurts be more serious the ships may be repaired after the battle, so as to avoid the necessity of weakening the fleet by sending them to harbor for repairs. For this purpose, the repair ships are provided with all the materials for rapid and effective work, whether the injury be to engines, turning-gear, or other department of the ship, while their crews are made up of skilled

mechanics, capable of handling every part of the intricate make-up of a modern ship of war.

Another new idea of recent development is the ambulance ship, a craft whose mission is one of mercy and relief, and which plays the part taken by the Sanitary Commission during our Civil War. There are two of these ships now with the fleets, known respectively as the Solace and the Relief, fitted up with the requirements of hospital work, and ready to take on board the wounded from an engagement and to provide them with a degree of comfort and care that they could not obtain on board a battle-ship. The idea is a happy one, and many valuable lives may be saved by the presence of these floating sanitariums, the main purpose of which is to convey the sick and wounded to hospitals in salubrious situations on shore, careful attention being given to their wants during the voyage.

CHAPTER VIII.

THE SUBMARINE TORPEDO-BOAT.

For the first idea of the submarine torpedo-boat we must go back to the Revolutionary War. This, like so many conceptions connected with the navy, was of American origin, and though the original boat of this character failed in its mission, it showed a mechanical ingenuity worthy of the inventive spirit of the American people.

This boat made its appearance in 1777, as the invention of a highly ingenious mechanic, a citizen of Saybrook, Connecticut, David Bushnell by name. It consisted of a turtle-shaped cask large enough to hold a man and carry a torpedo loaded with one hundred and fifty pounds of powder, mechanism being provided by which this could be fastened to the wooden bottom of a ship and fired when in this situation.

The cask contained air enough to support the operator for thirty minutes, and was fitted with an oar for rowing backward or forward, a rudder for steering, and an oar at the top which was expected to aid in placing the craft at any desired depth. A valved aperture at the bottom admitted water when the inmate wished to descend, while two forcing-pumps served to eject the water when he wished to rise. Entrance was made at the top, through a valve-like door, and there was a ventilator to supply fresh air when on the surface. The depth attained was indicated by a water-gauge, and a compass served to direct the course. Light was obtained from phosphorus to enable the inmate to read the compass and gauge. We are not told how the supply of fresh air was managed.

The arrangement for fixing the torpedo was equally ingenious. The operator could swim so low on the surface as to approach very near to a hostile ship in the night without being discovered. Then, sinking and rowing under its bottom, he was able, by a suitable piece of mechanism, to turn a wood-screw and drive it into the wooden hull. To the screw was attached a short rope, to the other end of which was fastened the torpedo carried on the rear portion of the craft. This was made buoyant, that it might rise against the

wood. Within it was a clock, set to run a fixed time, and then to release a lock which was arranged to explode the powder. By that time the daring operator might be far away.

Bushnell made his first attempt against a fifty-gun ship lying near Governor's Island, in New York harbor. The operator, however, failed to fix the wood-screw, and in the morning, thinking himself discovered, he cast off the torpedo. The clock ran for an hour, when the affair exploded with great violence. He made two other attempts, and in the end the submarine boat was fired upon and sunk. He subsequently sought to blow up the frigate Cerberus, from a whale-boat supplied with a torpedo, but by accident ran foul of a schooner, which was blown to pieces, three of its crew being killed.

Bushnell's last effort in this direction has become a noted historical event, since it gave rise to the famous "Battle of the kegs." He charged several kegs with gunpowder, so fixed that they would explode on touching any object, and set them afloat in December, 1777, on the Delaware, above the English shipping at Philadelphia. Being unfamiliar with the river, and deceived by the darkness of the night, he set his kegs adrift at too great a distance, and they were also detained by the ice, so that they were much dispersed on reaching the locality of the shipping. Day had dawned, and one of these kegs was taken into a boat by several persons, who suffered for their careless handling by its exploding in their midst. It was this that gave the British the lively alarm and set them to the active effort to sink these dangerous kegs which were celebrated by Hopkinson in his humorous verses.

Robert Fulton, the famous American inventor of the steamboat, was the next to experiment in this direction. The submarine boat invented by him was tried in 1801 in the harbor of Brest, France, and remained under water for an hour, during which he guided the boat with ease. As the French declined to purchase the invention, he tried it in England in 1804, but found as little encouragement there. He intended it as a torpedo-boat, to be used in naval warfare, but soon abandoned it to take up the problem of steam navigation. In 1814, however, during the war with Great Britain, Fulton suggested, in a letter to William Jones, Secretary of the Navy, the use of a spar torpedo-boat, the spar to strike a vessel's side beneath the surface. This idea was not utilized until fifty years afterwards.

The above are not given as the only examples of submarine boats. A boat of this kind was tried in England as long ago as the reign of James I., the invention of a Dutchman named Drebell, whose chief secret was the use of a liquid "that would speedily restore to the troubled air such a proportion of vital parts as would make it again for a good while fit for respiration." An inventor named Day lost his life in a descent in 1774. In 1859 a Chicago inventor named Delaney patented a boat supplied with compressed air for breathing, and raised or lowered in the water by the Bushnell method of pumping water out of or into a suitable tank.

In the Civil War attempts at submarine torpedo-boat warfare were confined to the Confederate service. A corps of artisans was organized for this purpose, and a number of small boats were built which were named

"Davids," as contrasted with the "Goliaths" of the blockading fleets. The most famous of these, built at Mobile and transported to Charleston, was about thirty-five feet long, its crew numbering nine, of whom eight worked the propeller by hand and one steered. It was claimed to be able to navigate under water for half an hour, and was designed to pass under the keel of any vessel lying at anchor, dragging a floating torpedo, which would explode on striking the vessel's bottom.

This craft had an eventful career. Built in 1863, she sank at her wharf in Mobile and drowned her original crew. She was raised and taken to Charleston, where, one night, she was swamped by the wash of a passing steamer and again sank with her crew. Again she was raised, and again sank, this time carrying six men to the depths. It would naturally be supposed that this record would stand in the way of her getting a new crew, but the water-dogs of Charleston were not to be deterred, and once again, after making several successful submarine dives, the David stuck her nose into the mud in Stono Inlet and all on board perished for want of air. For the fourth time she was raised, and now, while attempting to dive under the receiving ship Indian Queen, she fouled a cable and death was again the lot of her crew.

Raised a week later, Lieutenant George A. Dixon, an army officer, asked General Beauregard's permission to try her against the Housatonic, a new Union war-ship, lying in the North Channel. Beauregard consented on the condition that she should be used only as a torpedo-boat, her submarine record being much too discouraging. But ill-fortune clung to her

to the end, though she went to the depths with glory. Provided with a spar torpedo, the David struck the Housatonic in the side, knocking a hole below the water-line through which the war-vessel filled and went to the bottom in four minutes. Five of her people were killed or drowned, the rest escaping by taking to the rigging or being rescued by boats. As for the David, she vanished with all on board, whether swamped by the column of water thrown up by the torpedo or carried down by the suction of the sinking vessel will never be known.

The recent attack on the difficult problem of submarine navigation for war purposes yielded no important results until 1886, when Nordenfelt built a boat at Stockholm which could be run under water for five minutes at a time. He built several others of superior performance, though their use of steam-power proved a disadvantage in many ways. Other sources of power were tried by later inventors, but no satisfactory result was attained until electricity was introduced. Electric motors have been used in all late boats of this kind. Lieutenant Peral, of the Spanish navy, invented a boat in 1888, named, after him, the Peral, which attracted much attention at the time. It travelled one hundred and twenty miles without exhausting its electric storage batteries, and rose and sank easily, though its course could not be safely changed under water. Its air supply kept good for six hours at a time, and it discharged a torpedo at a mark four hundred metres away with excellent success.

Two French boats, the Gymnote and the Gouber, were produced about the same time and gave satis-

factory results, though, like the Peral, they had to come to the surface whenever they wished to change their course. All these boats could follow a perfectly straight route under water, by aid of the gyroscope, but could not turn without losing all knowledge of their direction. The Gouber weighed about two tons and carried a torpedo charged with one hundred and ten pounds of dynamite. In a trial in 1889 two men remained sealed up in her for eight hours, at a depth of thirty-three feet, and came up perfectly fresh. Their air supply would have lasted twenty-five hours. A similar boat was produced in England in 1888, the invention of P. Waddington, and Russia and other countries have experimented in the same direction.

The attention of the United States government was directed to this subject in 1887, in which year the Navy Department issued a circular offering inducements to inventors to produce a boat of this kind suitable for naval purposes. The principal features of the proposal were that the boat should have fifteen knots of speed on the surface, twelve when partly submerged, and eight when completely sunk, should be able to run for thirty hours at full speed on the surface, and retain power sufficient for a two hours' run under water at eight knots. She should be able to turn within four times her length without reversing her engines, sink out of sight in thirty seconds, and be strong enough to bear the water pressure at one hundred and fifty feet depth. An air supply sufficient for twelve hours was demanded, and the temperature was required to be kept down to 100° F. The maximum weight was to be two hundred tons, but about ninety was considered most desirable.

A number of boats have been offered in response to these proposals, one of the most interesting of which is the invention of Mr. George C. Baker, of Chicago. This craft, tried on Lake Michigan in 1892 and later, has a displacement of about seventy-five tons, and when running on the surface at normal draught shows two feet of the crown of her hull above water. The shell is of wood six inches thick covered by one inch sheathing of metal. The outside length is forty feet, the interior dimensions thirteen feet depth and eight feet width. Her power is derived from a storage battery, charged on board by a dynamo driven by steam-power. When the charge is completed, the fire is smothered by closing the air-tight furnace doors, the smoke-stack drawn down into the boat, and the dynamo reversed to run as a motor. The conning-tower has plate-glass windows on its sides and at top, and serves as a man-hole for entering the boat.

For the management of the boat under water the propeller screws are chiefly depended upon. Water is admitted sufficient to make the buoyancy of the boat equal that of the water, and the rising and sinking are controlled by setting the screws at an angle with the horizontal plane. The electric plant consists of a fifty horse-power motor driven by two hundred and thirty-two Woodward storage cells. This craft is adapted to carry two men, the pilot and his assistant, who have remained more than two hours under water at a time. The boat is controlled by two wheels, one to set the rudder, the other to change the angle of the screws.

The most recent and most interesting of submarine torpedo-boats is that known as the "Holland," the

invention of Mr. John P. Holland, which was carefully tested in Newark Bay and New York harbor during 1896 and 1897. Mr. Holland's experiments began in 1887, his operations attracting the attention of the government sufficiently to call out the somewhat rigorous proposals from the Navy Department.

The boat recently tested is fifty-five feet long and ten and one-quarter feet diameter, the hull being of a blunt cigar shape. Her displacement is 75 tons. The latest trial of this odd-looking craft was under the supervision of a board of officers from the Brooklyn Navy-Yard, who found it rather hard to keep track of the boat in her sudden and startling appearances and vanishings. During this trial the cover of the turret was not raised for two hours, and when the men came out they declared that they had remained perfectly comfortable, and that the boat was at all times fully under their control. The Holland boat has advantages over the lake boat mentioned in being more roomy, and therefore more comfortable to its inmates, while the torpedo-tubes which it carries at each end give it the means of inflicting a double blow on an enemy.

The Holland has two sources of power, a gas-engine for use at the surface, and a motor run by storage batteries in its under-water trips. The engine and motor operate a common shaft, an arrangement which permits the engine to be used in charging the batteries. Above the batteries, on each side of the vessel, are placed the tanks of compressed air, from which a steady supply of fresh air can be obtained by the crew until the charge is exhausted. The liquid fuel for the gas-engine is stored in the cellular bottom of the little

craft, and here also are the water-ballast tanks, which aid in the operations of diving downward and rising again to the surface. The boat is buoyant enough to rise to the surface with her tanks all filled and her crew on board, she being directed downward by altering the pitch of her rudders or side fins, and maintained at the required depth by means of delicate mechanism adapted to that purpose.

The Holland is provided with formidable powers of offence. In her bow is carried a tube for discharging a Whitehead torpedo, one of the most dangerous of modern destructive devices. In addition she carries two tubes for gun-cotton torpedoes, one pointing aft and one forward. The forward tube points upward, and can throw a gun-cotton projectile through three-quarters of a mile of air. The other is called an under-water torpedo-gun, and can drive its shell with accurate aim through two hundred feet of water. In a trial of her powers, the aerial tube, worked under partial air-pressure, threw a dummy projectile two hundred and fifty yards through the air, and the submarine tube, with fifty pounds' pressure, sent a three-hundred-pound weight through one hundred feet of water.

Mr. Holland's success in his experiments brought from the government in 1895 an order for a larger vessel of this type, in accordance with which a boat called the Plunger has been constructed at Baltimore. This is eighty-five feet long, eleven and a half feet diameter, and 168 tons displacement. Its estimated speed is sixteen knots on the surface and ten knots when submerged. The electric motor of the Plunger, fed from forty-eight chloride storage-cells, is of 70

THE HOLLAND SUBMARINE TORPEDO-BOAT.

horse-power, and is capable of propelling the boat under water for at least six hours. A conning-tower is provided, through the aid of which the boat is run when at the surface. When she sinks, a small dull-colored tube projects above the water, at whose top an inclined mirror throws downward a picture of the surrounding waters on a board in the conning-tower. This device overcomes the difficulty of directing the course of the vessel when submerged. An automatic gauge serves to show the depth below the surface. This ingenious device, based on the principle of the aneroid barometer, is of European invention.

If the Plunger, or any of her rivals, should prove a success, she must inaugurate a revolution in naval warfare which will utterly change the conditions existing in the twentieth century as compared with the nineteenth. The greatest and most vigilant battle-ship will be at the mercy of such a foe. It would be difficult, with the aid of the most powerful search-light, to discover at night the insignificant conning-tower of such a craft, while when submerged she could approach an enemy unseen and safe from all the guns of her helpless prey. Any harbor protected by boats of this class would be safe from an invading fleet, since no ship would care to venture within the bounds of almost sure destruction. A blockading fleet would be in almost as great peril, and with a sufficient number of these invisible, swift, and destructive little craft any country would probably be able to keep its harbors secure and its ports open against the most formidable naval powers of the world.

CHAPTER IX.

WAR SQUADRONS AND NAVAL RANK.

In the preceding pages we have sought to give a definite description of the development of the modern types of war-vessels, with a detailed statement of the several vessels which make up the existing navy of the United States, their size, power, armor, armament, and other distinguishing characteristics. The opening of the war with Spain in April, 1898, brought these vessels into active service after a considerable period of virtual inaction, the fleet being divided into squadrons, assigned to special stations, while numerous additions were made to it by purchase or subsidy. This section of the subject may be fitly closed with a list of the vessels composing the several squadrons and the names of their commanders, at the date of the declaration of war.

The Atlantic fleet was divided into two sections, known as the North Atlantic Squadron, stationed at Key West, under the command of acting Rear-Admiral William T. Sampson, and the Flying Squadron, stationed at Hampton Roads, under Commodore Winfield Scott Schley. Somewhat later was added to this a Northern Patrol Squadron, composed mainly of subsidized vessels, under Commodore John A. Howell. These squadrons were made up as follows:

NORTH ATLANTIC SQUADRON.

New York (flag-ship), armored cruiser, Captain French E. Chadwick.

Iowa, battle-ship, Captain Robley D. Evans.

Indiana, battle-ship, Captain Henry C. Taylor.

Puritan, monitor, Captain Purnell F. Harrington.

Terror, monitor, Captain Nicoll Ludlow.

Amphitrite, monitor, Captain C. J. Barclay.

Miantonomoh, monitor, Captain Mortimer L. Johnson.

Cincinnati, cruiser, Captain Colley M. Chester.

Detroit, cruiser, Commander James H. Dayton.

Montgomery, cruiser, Commander George H. Converse.

Marblehead, cruiser, Commander Bowman H. McCalla.

Wilmington, gunboat, Commander Chapman C. Todd.

Helena, gunboat, Commander William T. Swinburne.

Nashville, gunboat, Commander Washburn Maynard.

Annapolis, gunboat, Commander J. J. Hunker.

Castine, gunboat, Commander Robert M. Berry.

Vicksburg, gunboat, Commander A. B. H. Lillie.

Machias, gunboat, Commander John F. Merry.

Newport, gunboat, Commander Benjamin F. Tilley.

Bancroft, gunboat, Commander R. Glover.

Vesuvius, dynamite gunboat, Lieutenant-Commander John E. Pillsbury.

Dolphin, despatch-boat, Commander Henry W. Lyon.

Fern, despatch-boat, Lieutenant-Commander William F. Cowles.

Dupont, torpedo-boat (flag-ship of torpedo fleet), Lieutenant Spenser S. Wood.

Cushing, torpedo-boat, Lieutenant Albert Gleaves.

Ericsson, torpedo-boat, Lieutenant-Commander Nathaniel R. Usher.

Rodgers, torpedo-boat, Lieutenant Joseph L. Jayne.

Winslow, torpedo-boat, Lieutenant John L. Bernadou.

Foote, torpedo-boat, Lieutenant William L. Rodgers.

Porter, torpedo-boat, Lieutenant John C. Fremont.

Stiletto, torpedo-boat, Lieutenant H. Hutchings.

Talbot, torpedo-boat, Lieutenant W. R. Shoemaker.

Gwin, torpedo-boat, Lieutenant C. S. Williams.

FLYING SQUADRON.

Brooklyn (flag-ship), armored cruiser, Captain Francis A. Cook.

Massachusetts, battle-ship, Captain Francis J. Higginson.

Texas, battle-ship, Captain John W. Phillips.

Columbia, cruiser, Captain James H. Sands.

Minneapolis, cruiser, Captain Theodore F. Jewell.

NORTHERN PATROL SQUADRON.

Yankee, converted steamship, Commander Willard H. Brownson.

Dixie, converted steamship, Commander Charles H. Davis.

Prairie, converted steamship, Commander Charles J. Train.

Yosemite, converted steamship, Commander William H. Emory.

Katahdin, ram, Commander George F. F. Wilde.

ASIATIC SQUADRON (HONG KONG).

Commodore (now Rear-Admiral) George Dewey.

Olympia (flag-ship), cruiser, Captain Charles V. Gridley.

Baltimore, cruiser, Captain Nehemiah M. Dyer.

Raleigh, cruiser, Commander Joseph B. Coghlan.

Boston, cruiser, Commander Benjamin P. Lamberton.

Concord, gunboat, Commander Asa Walker.

Petrel, gunboat, Commander Edward P. Wood.

Monocacy, corvette (old navy), Commander Oscar W. Farenholt.

McCullough, despatch-boat, Captain A. C. Hodgson.

PACIFIC SQUADRON.

Rear-Admiral Joseph N. Miller.

Monterey, monitor, commander not assigned.

Monadnock, monitor, Captain William H. Whiting.

Bennington, gunboat, Commander Henry E. Nichols.

Marietta, gunboat, Commander Frederick M. Symonds.

Alert, gunboat, Commander E. H. C. Leutze.

Charleston, cruiser, Captain Henry Glass.

At subsequent dates numerous changes were made in these squadrons. The battle-ship Oregon, Captain Charles E. Clark, was brought from the Pacific coast and joined Admiral Sampson's fleet. The gunboat Marietta made a similar voyage around the continent.

The Charleston was sent to join Admiral Dewey's squadron, followed by the monitors Monadnock and Monterey, to the latter of which Captain E. H. C. Leutze was assigned. Captain Gridley, of the Olympia, was relieved from command on account of ill health, and died on the way home. Captain Lamberton, of the Boston, succeeded him. Captain Frederick Rodgers succeeded Captain Harrington—relieved on account of ill health—in command of the Puritan. The Flying Squadron was reinforced by the cruiser New Orleans, Captain W. M. Folger.

The cruisers Atlanta, Chicago, San Francisco, Newark, and Philadelphia, the gunboats Wheeling, Yorktown, and Princeton, and the Civil War monitors were under repair or preparation for service at various navy-yards. The San Francisco, Captain R. R. Leary, was later made flag-ship of the Northern Patrol Squadron, to which was added the Columbia and the Minneapolis, while the Yankee and the Yosemite were transferred to the North Atlantic Squadron.

To the North Atlantic Squadron were later added the fast steamships St. Paul, Captain Charles D. Sigsbee (formerly captain of the Maine); St. Louis, Captain Casper F. Goodrich; Harvard, Captain C. S. Cotton; Yale, Captain W. C. Wise; the relief ship Solace, Commander A. Dunlap, and others.

The above does not constitute the complete fleet, a number of other vessels having been added by purchase or subsidy, and adapted to various purposes, the principal war-vessels among them being the cruiser Topeka and the dynamite boat Buffalo, purchased abroad, and a number of yachts, etc., converted into gunboats.

RANK IN THE UNITED STATES NAVY.

The title of the highest rank of naval officers, not only in our navy but in those of several other countries, is that of admiral, modified into *amiral* in French, *almirante* in Spanish and Portuguese, and *ammiraglio* in Italian. The original English admiral was not a commander, but possessed those extensive powers afterwards exercised by the Lord High Admiral, an office last held by the Duke of Clarence, afterwards William IV. The earliest head of the American navy, Esek Hopkins, bore the title of Commander-in-chief, but on November 15, 1776, Congress decided on adopting the English titles, that of admiral to rank with general, vice-admiral with lieutenant-general, and rear-admiral with major-general. These titles, however, did not accord with the democratic sentiment of the people, and the highest officers in our navy bore the official title of captain until 1862. There was only one exception to this, that of Charles Stewart, who was accorded in 1859 the special title of Senior Flag-officer. The captains in the United States navy in command of squadrons were popularly known under the title of commodore, their rank being indicated by their broad pennant, but they were never commissioned under this title before 1862.

The Act of Congress of July 16, 1862, reorganizing the navy, recalled the grade of rear-admiral, and confirmed that of commodore, the latter to rank with a brigadier-general in the army. Nine rear-admirals were authorized to be commissioned on the active, and nine on the retired or reserve list, the number on the active list being subsequently reduced to seven, while that on the retired list has varied from time to

time. The senior three active rear-admirals were privileged to fly their special blue flag at the main-mast top, the next three at the foremast, and the remainder at the mizzen-mast. The first rear-admiral's flag was hoisted by Farragut on the Hartford, at New Orleans, August 12, 1862. Farragut was commissioned vice-admiral December 21, 1864, and admiral, July 25, 1866, these titles being created for him. David D. Porter succeeded him as vice-admiral in 1866, and on his death, in August, 1870, Porter succeeded to his title. It lapsed after his death, and there is at present no admiral or vice-admiral in our navy. These titles were borrowed from England, where they are employed for the active admirals of highest rank. The English "Admiral of the Fleet" is an honorary title conferred by the sovereign.

The admiral commands a fleet or fleets, the vice-admiral a fleet, or a division of a fleet under an admiral, and the rear-admiral a fleet or squadron. The commodore may command a division or squadron, be chief staff-officer, or command a vessel under an officer of higher rank.

The next in rank of the line-officers of the navy is the captain, ranking with the colonel in the army. Next in succession is the commander, ranking with the lieutenant-colonel, an office introduced in the United States navy in 1838, and succeeding him is the lieutenant-commander, introduced in 1862, and ranking with the major. These officers command vessels of a grade in proportion with their rank, the captain those of first or second class, the commander those of third or fourth class, and the lieutenant-commander those of fourth class. There are three other line-officers, the lieutenant, ranking with an

AUXILIARY CRUISER ST. PAUL.

army captain, the lieutenant (junior grade), ranking with a first lieutenant, and the ensign, ranking with a second lieutenant. The duties of a lieutenant are those of watch officer or navigator, or he may be appointed in command of smaller vessels. The ensign, the lowest grade of commissioned officer, bears a title introduced in 1862 to replace that of passed midshipman. He is a steerage officer, and may be ordered to duty in the forecastle, the fire-room, or to any other duty at the discretion of the commander. The title of midshipman, formerly given to the lowest line-officer in the navy, is now confined to graduates of the naval academy while awaiting promotion to the rank of ensign. That of passed midshipman—now ensign—belongs to one who has passed an examination entitling him to promotion to a lieutenancy.

In addition to the line-officers, our navy possesses four non-commissioned officials known as warrant officers, they receiving their appointments under warrant from the Navy Board or the Secretary of the Navy. These include the boatswain, gunner, carpenter, and sail-maker. The duties of these officers, except the first, are indicated by their titles. The boatswain has various and arduous duties. He and his mates have direct charge of the men, seeing that they respond promptly to orders and act with alacrity. It is their duty to keep a close supervision over masts and rigging, and to pipe all hands to duty for general work, the boatswain's whistle being heard in all exigencies on board ship.

The gunner has charge of everything relating to guns and ammunition, and must see that the ordnance is kept constantly in order for any emergency. The

carpenter has similar supervision over the masts and spars, it being his duty to see that they are always in good order; and the sail-maker has like charge of the sails.

The master, an officer of our older navy, took rank next below the lieutenants, his duty being to navigate the ship under direction of the captain. Hence he was often entitled sailing-master. This title is now confined to the merchant service, being the official title of a merchant captain. Master's mate is an obsolete title from the old navy. The master-at-arms is a petty officer who performs police duties on a man-of-war, such as enforcing order on the berth-deck, taking charge of prisoners, and other duties of this character.

The duties of some of the minor officers, such as the carpenter and sail-maker, have ceased to be necessary on any but our smaller vessels, masts and sails having vanished from the larger ones. On the other hand, there has arisen a corps of staff-officers which did not exist on earlier ships of war. The present paymaster and his assistants were preceded by the purser, whose accounts were reported directly to the Secretary of the Navy. The surgeon and his assistants were preceded by surgeons employed from civil life, and who purchased their own stores, their accounts going into the purser's reports. The naval constructors of the present staff were preceded by skilled men employed from civil life, and who similarly accounted for their expenses to the Secretary. These officers, with the chaplain and chief and assistant engineer, are now regularly appointed officials, forming the staff-corps of the commander of the ship, and accountable to him for the performance of their duties.

As regards flags, that of the admiral has four, of the vice-admiral three, and of the rear-admiral two white stars. When several admirals of the same grade meet, the senior displays a blue, the next a red, and the others white flags. The commodore has a broad blue pennant with one white star, with the same variation in color when several commodores meet. Any officer commanding a vessel, not flying the admiral's or commodore's flag, flies a narrow pennant at the main.

The United States Naval Academy, the source of supply for naval officers, was founded in 1845 by George Bancroft, Secretary of the Navy. Efforts to found an institution of this kind had been made previously, as by Secretary Jones in the war of 1812–14, but it was now first permanently established, it being formally opened, at Annapolis, Maryland, October 10, 1845. In May, 1861, on the outbreak of the Civil War, it was removed to Newport, Rhode Island, and was moved back to Annapolis in September, 1865. A line-officer, of a rank not below that of captain, has the superintendency of this institution, whose studies include seamanship, naval tactics and construction, ordnance and gunnery, steam-engineering, navigation, and a number of more general branches of education, the course of instruction extending over four years. Practical instruction and drill in seamanship, naval tactics, and the handling of ordnance are important essentials of the courses of study, practice cruises being given annually for instruction in seamanship and navigation. It is from this institution that the line-officers and members of the engineer corps of the naval and marine service are recruited.

PART III.

Armor and Armament.

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CHAPTER I.

THE CONTEST BETWEEN PLATE AND PROJECTILE.

THE vital element in modern naval architecture has been the long duel between arms of offence and defence, between the cannon and the iron or steel plate. It began at Kinburn in the Crimea, when the French floating batteries defied the fire of land-forts at half-mile range. The Monitor and Merrimac hammered each other at close quarters for three hours without a ball penetrating a plate. But the introduction of rifled guns, and their increasing weight and power, soon made a change. The four or five inches of iron armor became useless for defence, and a race began between the resistance of armor and the penetrating power of projectiles, which is still kept up.

The plates of the Civil War monitors were of hammered iron, but the rolling of large iron plates soon after began, these increasing in thickness as the force of projectiles grew. In 1867, as no reliable plate thicker than six or seven inches could at that time be produced, the system of combining a number of plates was adopted. But tests have proved that solid plates have greater resisting power, and these alone are now

ADMIRAL DEWEY.

REAR-ADMIRAL SAMPSON.

COMMODORE SCHLEY.

CAPTAIN SIGSBEE.

used. Thus a 60-pound round shot that failed to penetrate a 4-inch solid plate has been found to pass readily through six inches of 1-inch plates laid together.

By 1872 rolling-mills had become able to produce 12-inch plate of good quality, but even this thickness was not enough to keep out the projectiles of that day, and thicker armor-plate became necessary. The limit was reached about 1880, when the British ship Inflexible put on armor twenty-four inches thick, France and Italy closely following. But the power of the gun was steadily increasing; an 80-ton gun sent its projectile through three 8-inch iron plates, and it began to look as if no weight of iron that could be laid on a ship's sides would suffice to keep out the shells of large rifled guns.

Greater resisting power was wanted, steel was found to be far tougher than wrought iron, and the use of iron plate approached its end. In 1877 what is known as compound armor—wrought iron faced with steel—was first produced. This was manufactured by pouring molten steel, at a great heat, over a wrought-iron plate, or by placing a thin steel plate at a short distance from the iron and filling in the space with molten steel, which bound the two plates together. The compound of steel and iron was then toughened by being compressed to about half its original thickness. The result proved of great importance. The steel face could not be penetrated by the shot of that day. It had to be cracked and broken up before the iron could be reached. In consequence compound armor was used on British ships for about ten years after 1880.

The question now arose, if a steel face was of such

utility, would not solid steel be better? A test was made in Italy in 1882, with plates of the two kinds, each 18.9 inches thick. Two shots from the 100-ton gun wrecked the compound plate, while the steel plate bore three shots and still retained powers of resistance. The final conclusion reached abroad was that compound plates—about one-third steel—were the best up to twelve inches, beyond which solid steel was much superior.

Meanwhile, the development of the projectile was not confined to size alone. Harder material was used. Chilled iron gave way to cast steel. Forged steel followed. The penetrating power of shells enormously increased, their greater hardness and toughness being made effective by the immense velocities with which they were hurled from the muzzle of the gun. Such was the state of affairs in 1886, when the United States came into the market for heavy armor of home manufacture. The facts had been threshed out by experiment abroad. Only solid steel was wanted for American ships. The plant to make it was lacking, but a difficulty of this kind was a small matter to American mechanics, and within two or three years there were shops in this country ready to vie with the best of those abroad in the production of armor-plate and great guns. The rapid development in this direction has been described in a former chapter.

In 1890 a new material was produced at the Krupp works in Germany,—steel alloyed with a small percentage of nickel, which added considerably to its toughness. It was at once adopted in this country. It is to the United States, however, that the world owes the greatest improvement in armor-plate, the

adoption of the Harvey process of surface-hardening, first tested in 1890. The problem had been how to make a plate hard enough in the face to break up steel shot and tough enough in the back to hold together if the shot got through. Compound plates were not hard enough at the surface. Solid steel was too brittle at the back. The problem lay open for solution.

It was solved by the Harvey process, which gave to the steel plate a very hard face with a soft and tenacious back. The method consists in hardening the face of the plate in a manner somewhat resembling the cementation process of making steel. In Harveyizing, one surface of the steel plate is planed off, and two such plates are laid together, with a layer of animal charcoal equal to their own thickness between. They are then covered with sand and heated to a temperature of 1800° F. This heat is kept up for two weeks, at the end of which time the carbon is found to have made its way deeply into the surface of the plates, which have grown very hard. After cooling for a week, the steel is heated again and chilled with water. It is now found to be so hard that no drill can make holes in it. Rivet holes have to be made in advance, or the surface softened by local heating with electricity.

The resisting power of nickel steel with Harveyized face is extraordinary. The United States has kept up a constant series of tests at its proving-grounds, accepting no plate whose endurance has not been thoroughly proved. In a test in 1895, a 16-inch steel plate, with thirty-six inches of oak backing, was attacked at short range by guns of ten, twelve, and thirteen inches bore. The 10-inch gun caused a penetration of eleven

inches, but no cracks appeared and the backing remained sound. The projectile of the 12-inch gun was destroyed after penetrating seventeen inches. The plate was cracked, but the backing held good. The 13-inch gun sent its 1100-pound steel shell through the plate and its backing, and twelve feet deep into the sand behind. The resistance of a single plate to three such shots at short range was remarkable. No one plate is ever likely to receive a similar battering, particularly at such short range, in actual battle, and a vessel armored with plates like this is practically secure. In another test, in which the powerful 13-inch gun was used, with its striking energy of twenty-five thousand foot-tons, the shell, after penetrating ten inches into the plate and considerably splintering its oak backing, was completely destroyed.

One of the plates of the battle-ship Massachusetts was attacked by two 12-inch 880-pound forged steel shot, the first with a muzzle velocity of 1410, the second of 1853 feet per second. The first, calculated to pierce twenty inches of iron and 14.4 inches of steel, broke up after penetrating eight inches. The second, whose penetrating record was 24.2 inches of iron and 19.4 inches of steel, pierced the plate but eleven inches, slightly cracking it. In other tests a 14-inch plate has been found to pass the trial for seventeen inches of ordinary steel, while a Carnegie plate has shown the astonishing power of resisting a projectile that would have passed through two and a half times the same thickness of iron.

The net result of the Harvey process is that armor has regained an equality with the power of the gun. It is true that there are guns and projectiles now in

use which, on the proving-ground, can break up any plate yet produced. But in action steel plates are not exposed to proving-ground tests; contests take place at much greater distances. Many of the balls strike obliquely, and in no case are many direct hits likely to fall upon a single plate. American battle-ships, therefore, with their armor of Harveyized nickel steel, can fairly bid defiance to any shot directed against their central region, to which the main defence is applied.

A recently considered defect in the use of shells against armor is their explosion on contact, or before they can penetrate to a sufficient depth to do much harm. Invention is now at work in efforts to devise means to retard explosion, and give shells time to penetrate more deeply before they explode, and do more damage to the plate. Until 1894 the tendency prevailed abroad to use very heavy armor for a certain distance along the water-line, employing thin armor for the remainder of the length. This system has been changed, and somewhat lighter armor is now used and carried over a larger section of the side. Both these methods have been tried in American ships. Only actual test in battle can prove which is the best. So far the question of armor has been one of experiment in times of peace. The real utility of the different systems needs the stern test of war.

In adapting large plates to the sides of ships, they are bent to the required curve in enormous hydraulic presses, or shaped under great steam-hammers. They are then trimmed up in special planing- and sawing-machines. In fastening them to the ship bolts of two or three inches diameter are employed, being screwed some distance into the plate. In each group of plates

made one is selected for government test, being fired into at short range to see what it will stand. The tests made are very severe, and plates that pass them can be safely trusted to do their duty in battle. The greatest thickness of plate used is twenty-one and a half inches on some French and Italian battle-ships, with the exception of the twenty-four inches of compound armor on the British ship Inflexible. The heaviest used on American ships is the 18-inch Harveyized steel plate of the Indiana, Massachusetts, and Oregon.

CHAPTER II.

MODERN ORDNANCE AND ITS WORK.

THE cannon used in recent naval warfare are remarkably different from those used in the early wars of this country, and vastly more powerful even than those employed in the Civil War. The old smoothbore gun, with its powder and round ball rammed in at the muzzle, now exists only as a curious relic of the past, the rifled, breech-loading cannon, with its elongated projectile, having almost everywhere taken its place; while naval battles, formerly fought at a few hundred yards' distance, can now be fought at as many miles.

In this modern development of ordnance the inventors of the United States have played a prominent part. The Paixhans gun, for instance, long prominent

in Europe, was but an adaptation of the columbiad, invented in 1812 by Colonel Bomford, of the United States Ordnance Department, as a long cannon for firing shell. In 1856 Lieutenant Dahlgren, of our navy, invented the gun which bears his name, and which was the favorite piece of ordnance in the navy at the outbreak of the Civil War. It was made of a solid mass of cast iron cooled from the outside and bored out. This was improved on by the Rodman gun of 1860, which was cast hollow and cooled from the inside, cold water being made to flow through the bore while the exterior was kept hot. This put the metal in a state of tension which fitted it to bear the strain of discharge. These cannon proved far superior to the wrought-iron ones of an earlier date, one of which burst on the steam-frigate Princeton in 1844, killing, with a number of others on board, the Secretary of State and the Secretary of the Navy.

Meanwhile, the art of rifling, long before used with small arms, had been applied to cannon, cast-iron rifled pieces being produced alike in Sardinia and in Sweden in 1856. Their value was soon proved, and to fit the guns in use to bear the greater strain, the custom was introduced of shrinking a wrought-iron jacket over the breech of a cast-iron gun. This jacket was of slightly smaller diameter than the gun and was expanded by heating until it would just slip on. In cooling it brought an enormous pressure to bear upon the gun. The Parrott rifled cannon used during the Civil War were made in this way. Commander John M. Brooke, of the Confederate navy, improved on these by shrinking a double series of bands upon the breech.

But cast and wrought iron alike were soon to be set aside in favor of cast steel in the manufacture of guns. This material was first employed for the purpose in 1850 by Krupp in Germany and Whitworth in England, and as soon as the art of working steel became sufficiently perfected for the product to be trusted iron was abandoned for steel in the manufacture of heavy guns, which were strengthened in the manner described for cast iron, that of shrinking a hoop, or a number of hoops, of steel upon the breech. In the development of the Armstrong gun a different method was employed. Around a core of wrought iron red-hot iron bars were coiled, shrinking firmly into place when cooled. In a later form of the Armstrong gun the core was made of toughened steel, over which were shrunk hoops of forged steel, firmly locked together to prevent any tendency to slip. This was superseded by the wire gun, in which a flat wire or riband of steel was first coiled firmly around the breech, over which hoops of forged steel were shrunk.

In 1893 and again in 1896 there was tested at the proving-grounds at Sandy Hook a wire gun of American invention which admirably bore the tests applied, and may take its place as the cannon of the future. This, the invention of Captain J. H. Brown, differs essentially from those described. Instead of winding steel ribands or shrinking hoops around a central core, it discards the solid core and builds up the central tube of segments,—bars or staves of steel laid side by side to form a cylinder. Around these steel wire one-half inch square is wound in several successive sections, no less than seventy-five miles of wire being used in making a 10-inch gun. The gun is then bored out,

heated internally, and shrunk on to a thin steel lining. This gun has been found to have remarkable elasticity, its strength being much greater than that of the hooped gun. Thus while the hooped 10-inch navy gun has a muzzle energy of 15,285 foot-tons, the Brown gun, which is only two tons heavier, will stand without damage a muzzle energy of 37,800 foot-tons.

In rifled guns the spherical balls of the old smooth-bores have been replaced by cylindrical projectiles, sometimes of several feet in length, the purpose of the rifling being to give the projectile a rotation on its longer axis. This rotary motion keeps it steady during flight, enabling far more accurate aim to be made, while its directness of motion adds largely to its range. In modern guns the advantage of rifling has been added to by an increase in the length of the bore and the use of slow-burning powder. With this the pressure is much less at the moment of explosion than in quick-burning powder, the gas being given off more slowly, and acting on the projectile with steadily increasing force. In a long gun, therefore, the powder has more time to act on the projectile, and drives it from the muzzle at greater speed. In the guns of twenty years and more ago it was found that while none of the short muzzle-loaders gave the shot a velocity of sixteen hundred feet a second, the long gun drove it from the muzzle at two thousand feet a second. The lengths of guns are estimated in calibers, the caliber being the diameter of the bore. A few years ago thirty-five calibers was the limit attempted in rifled guns, but to-day guns of much greater length are produced. Canet, a French manufacturer, has gone as far as sixty and eighty calibers, though this

process is necessarily limited by the awkwardness attending the use of extremely long and slender guns.

The effect of this increase in length is marked. A 6-inch gun of thirty calibers is capable of penetrating fourteen inches of wrought iron at its muzzle, while one of fifty calibers can penetrate twenty-one inches. The effect of the eighty calibers of some French guns is to give the enormous muzzle velocity of over three thousand two hundred feet a second, its power of penetration being correspondingly great. This increase in the length of guns, taken in connection with the use of slow-burning powder, has added so greatly to their effectiveness that the weight of armament carried on ships can now be considerably reduced without loss of penetrating power.

An important result of the increase in the length of guns is the adoption of breech-loading in place of muzzle-loading. While comparatively short guns were used it was simple and easy to ram the powder and shot in at the muzzle of the gun, but with the long guns now produced, and particularly since the adoption of the turret system, this has become impossible, and breech-loading is alone now employed.

It was tried in the early Armstrong rifled guns, but proved unsatisfactory, and the British navy continued to use muzzle-loaders long after they were generally abandoned by other nations. The idea of breech-loading is by no means new. It was tried as early as the sixteenth century, and at various later dates, different methods of closing the breech being used. At present this is done by three different devices,—the screw, the wedge, and the interrupted screw. The first two of these express their character in their name.

In the screw system a vent piece is thrust downward through a hole in the top of the gun and is held in place by a screw driven strongly against it. This screw is hollow and the charge is introduced through it. The wedge system used in the Armstrong and Krupp guns dispenses with the screw, a strong wedge being pushed downward into the slot and held firmly in place.

Of all the systems employed, however, the interrupted screw, an American invention, is the simplest and most easily handled. It is alone used in the United States navy, and is being adopted abroad. The bore of the gun, which runs of one diameter through the whole mass of steel from muzzle to breech, is in this system closed at the breech by a heavy plug, on whose surface is cut a strong screw fitting into a corresponding screw in the breech. The thread of the screw is cut away in sections both in the plug and the breech, so that the plug can be pushed in without turning, and then fastened by a partial turn, causing the screws to engage. The plug is now made in a conical form, in order that, as soon as the threads of the screws are disengaged, it can be swung out with a single motion on the strong hinge by which it is supported when withdrawn.

One of the principal difficulties presented by breech-loading mechanism, the escape of powder gas at the breech when firing, has also been overcome by the invention of an American, from whom the device is known as the Broadwell gas-check. This is a ring of soft steel which bears against the surface of the closing wedge. When the gun is fired the ring is forced back-

ward and expands, effectually closing the vent and preventing the escape of gas.

A variety of methods are in use regarding the number and depths of the grooves in rifled guns. Since breech-loading has become common, the number of grooves in the gun has been increased, their twist being made more rapid, while they are not so wide and deep as formerly. The projectiles are usually furnished with copper rings, which expand to take the grooves and give the requisite rotation to the shot.

Naval guns of the present day are of less diameter than some of those used in the Civil War, when the monitors bore 15-inch smooth-bores. The charges now used are so much heavier and the recoil so much greater that a 13-inch rifled cannon is as heavy as it is safe to use on ship-board, guns of wider bore being confined to land fortifications. The latter are sometimes made as large as 16-inch caliber, some guns of this size being used for United States sea-coast artillery, their projectile weighing two thousand three hundred and seventy pounds. Still larger guns have been made in Europe, but the best authorities doubt if rifles of more than 12- and 13-inch bore can be used to advantage. Some of the most powerful modern cannon are sighted for eight thousand seven hundred yards, at which distance an object ten feet high may be hit. The distance to which a ball can be thrown, with full elevation of the gun, is usually estimated at as many miles as there are inches in the bore. But the elevation necessary for this is impossible on board ship, while accurate sighting must be confined to a much smaller range.

As regards the weight of projectile used in guns of

EIGHT-INCH GUN AND CREW OF THE ATLANTA.

different caliber, it may be approximately obtained in any case by a simple calculation, that of cubing the number of inches in the bore and dividing by two. The projectiles for the large guns are several feet in length, and take half their weight in powder for their discharge. It need scarcely be said that warfare with these great guns is a very costly operation.

The range-finder is an important adjunct of a modern gun. The gunner of old, who had the side of a ship at a few hundred yards' distance to hit, could locate his mark by squinting through the sights of his gun, but where the projectile has miles to travel such methods as this would be a sheer waste of powder and shot. Several range-finders of American invention are in use, they being usually based on the principle of using two telescopes, as far apart as possible on either side of the gun, and calculating the range of the object from the angle which each makes with it. The requisite elevation of the piece, of course, depends upon the distance of the object. One of these position-finders was tested at Sandy Hook a few years ago with the satisfactory result that ten consecutive shots were dropped within a space of eight and a half yards wide and less than two hundred yards long. A thoroughly trained modern gunner will waste few shots in firing at a ship several miles away.

There are two other forms of modern cannon of which we have already spoken, the dynamite gun and the torpedo-tube. In both these, on account of the dangerous character of their explosives, no powerful charge can be used, compressed air being usually employed. The dynamite gun, while forty feet long, has a barrel of $\frac{3}{8}$-inch iron, with $\frac{1}{8}$-inch brass tubing.

The projectile is of brass, forty inches long, rotation being given it by spiral vanes fixed to its base. It has a conical cast-iron point, twelve inches long. At a trial in 1895 dynamite shells were thrown as far as two thousand five hundred yards, and one containing one hundred pounds of dynamite was thrown a distance of two miles. Great accuracy of aim was attained. This dangerous weapon is an object of dread by naval officers, who fear that the shell may explode in the gun, and the torpedo-tube has rarely been effectively employed. They are both, as yet, things of dreadful possibilities.

The main means of defence employed in modern naval warfare against the torpedo-tube, with its dreaded projectile, is the search-light, an adaptation of the electric light from whose searching beam it is not easy for anything floating to escape. This, the gleaming ray of the electric arc, reflected from a parabolic mirror, forms the most intense artificial light known, its space-piercing powers being extraordinary. The great search-light displayed at the Columbian Exposition in 1893, and at the San Francisco Midwinter Fair in 1894, is now on Echo Mountain, California, and throws a light by which a newspaper may be read thirty-five miles away. Its light is visible at the island of San Clemente, one hundred and five miles distant, and it is impossible to say how far it might be seen but for the convexity of the earth.

The search-lights used on ships are of great power, the projectors now in use varying from three thousand to forty thousand candle-power. Their purpose is to illuminate the surface of the neighboring waters, and it is desirable to have them as near the water-line as

available, that they may have a more direct sweep. So far, in the contest between search-light and torpedo-boat, the former has come out victor, but in this rivalry eternal vigilance is the price of life, for a minute's withdrawal of the search-light from the midnight waters in time of war might result in the instant destruction of the greatest battle-ship, with all her crew.

The search-light, however, considered in itself, would be of no avail against the torpedo-boat. Its mission is confined to the discovery of this agent of destruction; to stop this in its dread mission something more is needed. The great guns of cruiser and battle-ship would be useless against so small and swift an antagonist, whose crew, reckless of death, might discharge their deadly missile and shoot away again before a shell from one of these slow-acting weapons could reach them. The exigency has been met in the invention of the rapid-fire gun, a weapon which sweeps the sea with such a shower of balls that the torpedo-boat is forced to fly in haste to escape being riddled like a sieve. In the contest between torpedo and ship the latter seems now in the advance, the search-light and rapid-fire gun, in combination with the vigilance of disciplined crews, having gone far to disarm this terrible antagonist.

It is not only against the torpedo-boat that this new development in gunnery is of service. It is in all respects one of the most serviceable weapons of war, and some account of its evolution is here in place. The rapid-fire gun had its origin in the machine-gun, of whose early forms the French *mitrailleuse* is the best known. This consisted of twenty-five barrels in rows of five, the breech-block having twenty-five chambers,

each carrying its cartridge. By the turning of a crank these were rapidly discharged, while several breech-blocks were loaded in advance. The Gatling gun, the next to follow, is now, in its perfected form, in use all over the world. This consists of a cluster of rifle-barrels arranged around a central shaft and rotated by a crank. The magazine contains a supply of cartridges, which drop down and are rammed home one after another as the barrels rotate. This, in the later improved forms, is done with such rapidity that the gun can discharge its balls at the rate of three thousand a minute, and can carry in its limber cartridges for ten thousand rounds.

The Gardner gun has only two barrels, and the Nordenfelt from two to seven, placed side by side. They do not pour out bullets at the enormous rate of the Gatling, but quite rapidly enough for effective work. The Maxim machine-gun, an American invention, is so arranged as to be automatic in its action. The operator has but to press the trigger to fire the first shot, and by keeping his finger on it, the discharges rapidly follow until the magazine is empty, the recoil of the gun supplying the power for loading the next cartridge. The Hotchkiss revolving cannon has barrels of 1½-inch caliber, a single mechanism loading, firing, and extracting the empty shells. It is effective but rather cumbersome, and is being replaced by rapid-fire guns of the same caliber.

Machine-guns were designed for service against bodies of men, not against the sides of ships. For this purpose something intermediate between the machine-gun, pouring out its balls from a hopper, and the great but slow cannon was needed, and the coming of the

torpedo-boat expedited its appearance. In 1877 came the Nordenfelt four-barrelled gun, of 1-inch caliber, which fired in a minute two hundred and sixteen shots large enough to sink any torpedo-boat of that day. But faster torpedo-boats appeared, their vital parts protected with coal, and to meet them came the Hotchkiss 3- and 6-pounder cannons, adapted to shell, of which they could fire twenty-five to thirty a minute. Six of these small guns, of 2¼-inch caliber, can fire in a minute a weight of metal equal to that of the projectile of the great 12-inch cannon, and, though of far less penetrating power, they still are able to play an important part in naval warfare. Even if two only of these 6-pounders bore on a coming torpedo-boat, they could fire fifty shots within the minute she would be under fire.

But a new type of craft appeared, the torpedo-boat destroyer, very fast vessels, ranging from four hundred to twelve hundred tons. Vessels of this class could defy the powers of the 6-pounder, as was demonstrated in 1891, in the battle between the ironclad Blanco Encalada and the torpedo gunboats Almirante Lynch and Almirante Condell in Caldera Bay, during the insurrection in Chili. The ironclad carried three 6-pounders, with which she hit her assailants more than once, yet they succeeded in torpedoing and sinking her. Three years later the torpedo gunboat Sempaio sunk the Aquidaban off Desterro, Brazil, though hit more than thirty times by machine-guns in her approach. Evidently a larger quick-firing gun was needed, and it quickly came. It appeared, indeed, before the fight in Caldera Bay, in the Armstrong 4.7-inch quick-firer, a great advance on any-

thing that had been produced before, but which was soon followed by the 6-inch gun, capable of throwing 100-pound shot, as against the 45-pound of the 4.7-inch gun.

In a competitive trial at Portsmouth, England, between the 4.7-inch rapid-fire and the 5-inch service breech-loader, it was found that the new piece fired ten rounds in forty-seven seconds, while the slow-firer took five minutes and seven seconds for the same task. Thus a war-ship with the new gun could plant twelve shots into a torpedo-boat where the old gun could plant only two. And in the first case there would need to be only slight changes in aim, while in the second the change would be considerable, and time lost in this. It may, indeed, be said that the invention of the quick-firer has robbed the torpedo of half its terror. Torpedo netting has ceased to be of use. The quick-firer more than takes its place. The torpedo-boat is still a thing to be dreaded, but is no longer the terrible engine of war that it was, and the day may come, with the development of weapons and means of defence, that it will be abandoned as useless and as simply a coffin for its crew.

The distinguishing feature of the rapid-fire gun lies in its breech mechanism, which is so simplified that the operations of handling and loading may be performed with ease and rapidity. The movement of the breech-block is made so simple that it needs little more than the touch of a lever to remove and replace, the same movement discharging the empty shell. The ammunition in the smaller guns of this character is made up like a rifle cartridge, the powder and projectile in one case. In the larger guns, from 4-inch

MAXIM AUTOMATIC GUN FIRING FOUR HUNDRED SHOTS PER MINUTE.

upward, the powder and projectile are separate, for convenience of handling. In the 6-inch gun, for instance, the projectile weighs one hundred pounds, which is as much as a man can handle with the necessary quickness. This gun can deliver about eight aimed shots a minute.

The 6-inch gun can penetrate fifteen inches of wrought iron at the muzzle and nine inches at two thousand yards, and about half that thickness of the hardest steel armor that can be made. Guns of this character, firing shells loaded with some of the powerful explosives now known, are capable of immense destruction. They can riddle the more lightly protected parts of ships, and their shells, if bursting under barbettes and turrets, which they cannot harm directly, might put out of service all their guns at a blow. In the battle of the Yalu the rapid-fire guns of the Japanese made frightful havoc in the Chinese ships, tearing them open, mowing down every man in their track, setting them on fire, and sending two of them to the bottom.

The rapid-firing gun has no special principle that separates it from the slow-firer, its rapidity being due to the greater quickness in opening the breech,—one motion being used instead of two; to the use of a cartridge-case, which saves the necessity of sponging out the gun after each round; to the use of springs to return the gun at once from the recoil; and to the sights being placed in the carriage instead of on the gun, so that the gunner can aim while the piece is being loaded.

These various adaptations make up the rapid-firer, and in principle there is no limit to its size, though

there is in practice, since the weight of the projectile must be considered. It should not be heavier than one man can handle with the necessary quickness. In the crew of the 6-inch gun one man's duty is to handle the 100-pound shot, and to do this six times a minute is as much as any man can stand even for a few minutes at a time. The Armstrong firm has produced 8-inch rapid-firers, and the Canet (French) firm claims to have made rapid-fire guns of 9.4-inch caliber. But as the first of these needs a projectile of over two hundred pounds, and the second one of three hundred and thirty pounds, it is obvious that these great weights cannot be handled with the necessary quickness. The United States navy, therefore, limits its quick-fire guns to pieces of 6-inch caliber. Yet the principles involved can be applied to the larger guns and the rapidity of their fire increased if deemed necessary.

As regards the smaller rapid-fire guns, which make up the secondary batteries of our ships of war, their quickness of action is phenomenal, considering that the hopper method of feeding in the balls is not used, as in the machine-guns. In a government trial, the Driggs-Schroeder gun, an American invention, fired forty-three shots in a minute, eighty-three in three minutes; the Hotchkiss did practically the same; the Sponsel—made in Connecticut—somewhat less, and the Maxim-Nordenfelt twenty in a minute, sixty-five in three minutes. The time taken to dismount the gun and replace it in firing position varied from about half a minute to three minutes. But it must be said that results like these can be had only under the most favorable circumstances. In actual practice it would

be physically impossible to feed the guns at such a rate, and so rapid a fire could not be long maintained without overheating them.

From all this it is evident that the ship which lacks rapid-fire guns of large caliber is obsolete as compared with the ship that possesses them, while the smaller guns are considered equally indispensable. On ship-board machine-guns are usually placed in the fighting-tops of the military masts, where they can sweep the deck of an opponent. The 1- to 6-pounder rapid-fire pieces are placed in the tops or on the bridge or higher deck, for similar purposes, while the 4- to 6-inch guns are placed in sponsons built out on the ship's sides or behind gun-screens on the main deck. While it is true that a single well-directed shot from a 13-inch cannon may disable a heavily armored antagonist, yet greater dependence is to be placed on the smaller armor-piercing shells, which can be discharged, with accurate aim, at the rate of six to eight a minute, with force enough to penetrate the thinner steel of the sponsons and gun-shields and burst with deadly effect among the gunners.

Rapid-fire guns are usually provided with a shield, a steel plate from half an inch to several inches in thickness. This is pierced to allow about half the barrel to protrude, and an upright slit running from the centre nearly to the top allows the gunner to sight his piece. The shield is sometimes vertical, sometimes its upper edge is inclined backward at an angle of 45 degrees, so that a projectile striking it may glance off. Guns of this character would soon grow too hot to handle if long used, but they are rarely employed for more than a few minutes at a time, and do not have the opportunity to become heated.

CHAPTER III.

POWDER AND PROJECTILES.

In the evolution of modern ordnance the character of the explosive used has become a question of high importance, many improvements having taken place in the manufacture of gunpowder, while numerous other explosives have come into use. In former times there was a neat simplicity about powder. Two kinds were used, one of fine grain for muskets, and the other of large grain for cannon, and little thought was given to the question of quality. The development of rifled artillery has directed careful attention to the characteristics of explosives, particularly those used in the larger cannon, where a slow-burning powder became imperative. This was for two reasons. A large charge of quick-burning powder would bring an enormous pressure upon the powder chamber of the gun before the projectile had begun to move, while the pressure would decrease as the projectile moved down the bore. This dangerous initial pressure was overcome by the adoption of slow-burning powders, which, while not straining the breech, exerted a steadily increasing pressure on the projectile, pushing it with the greatest energy at the instant it was leaving the muzzle of the gun. In this way much higher muzzle velocities might be attained, with decreased strain upon the gun.

The adoption of slow-burning powder had its effect

upon the length of the gun. If the gun was too short, the projectile would be driven out before all the powder was burned, and a large portion of the powder would be wasted, being blown out unconsumed. An instantaneous photograph of a gun at the moment of discharge shows this, the unburned portions of the powder appearing like a hail of small projectiles. This fact has led to the lengthening of guns in order to utilize all the force of the powder, it being found that a long gun of small caliber is equally effective with a short one of larger caliber.

To produce a slow-burning powder, it is necessary to form it in grains of considerable size, compressed in moulds into cubes or other forms, those of the greater density being the slower burning. A highly glazed powder also burns more slowly than an unglazed one, the glaze retarding the action of the fire. The powder itself is of two kinds, the ordinary black, and the brown powder, the latter being made from straw instead of wood, and having a larger proportion of carbon and a smaller proportion of sulphur, the proportion of saltpetre remaining nearly the same.

Of late years all these points have received close attention, and the kind of powder used is closely adapted to the character of the gun, each class and caliber of cannon needing a special powder. A powder composed of comparatively small grains of irregular size and shape burns with great rapidity, and almost instantaneously gives rise to a large volume of gas, the pressure in the bore of the gun being sometimes as high as sixty tons to the square inch. In the large hexagonal prisms now made, of an inch or more in diameter, the pressure has been reduced to about

fifteen tons, while the velocity of the projectile is greatly increased. In 1870 the initial velocity of projectiles ranged from one thousand to thirteen hundred feet a second. At present velocities of from two thousand to two thousand six hundred are attained, with low pressure on the bore of the gun.

One defect, however, was found to exist in the large grains of pebble or prismatic powder. When lighted on the surface, the burning area was largest at first and rapidly decreased as the grain grew smaller. Hence the maximum pressure on the bore appeared almost before the projectile began to move. This difficulty has been overcome by an American artillery officer, General Rodman, who conceived the idea of piercing a hole through the centre of each large grain or pellet of powder. This burned interiorly, the area widening as that of the outer surface narrowed, so that the evolution of gas was kept uniform and the pressure upon the projectile steady. Of course, it must be borne in mind that the expression "slow-burning" in the above remarks is to be taken in only a comparative sense. Slow and rapid burning, as applied to explosives, means the difference between nearly and quite instantaneous.

Powder has taken steps of development beyond those here indicated, it being thought desirable to produce a powder of higher initial velocity, with low pressure, and with a reduction in the quantity of smoke. Within late years a number of powders have been invented which possess these requisites, their practically smokeless character being one of their chief features of utility. There are several classes of these, composed of nitroglycerin or other nitrates, or

nitro-derivatives of picric acid and other hydrocarbons. These powders are found to impart much higher velocity to projectiles than ordinary gunpowder, without increase of pressure, the best of them being those which give maximum velocity with least pressure, and without chemical change when in the magazine. Various explosives of this kind are liable to such injurious changes.

Cordite, the powder of this kind used in the British navy, has received its name from its resemblance, when manufactured, to a gray cord. It is more powerful than ordinary powder, and nearly smokeless. Indurite is the kind adopted for the United States navy. In the trials of this at the Indian Head proving-grounds, it was found that a 26-pound charge fired from a 6-inch gun gave to a 100-pound ball an initial velocity of 2469 feet per second, while its pressure on the chamber was only 13.96 foot-tons. It must be borne in mind, however, that results like this do not fully indicate the value of any of the new powders, since they may have detrimental qualities which greatly reduce their usefulness in practice. The tendency to alter in composition while in the magazine is the chief of these. The explosive may not only deteriorate, but become dangerous.

In truth, the magazines of modern war-vessels are regions of constant danger, and demand an incessant supervision. Fires are likely to break out in the coal-bunkers, whose heat may penetrate to the magazines, and precautions against this peril are necessary. It is not long since serious fires occurred on both the New York and the Cincinnati from spontaneous combustion of coal, and a radical reconstruction of the

coal-bunkers of our ships was deemed necessary. In the British navy linings of asbestos and other non-conducting materials surround the magazines. France and Germany drive cold air into the surrounding spaces. In Italian ships provision is made for the escape of gas that may be produced in the magazines. In our new battle-ships a double bulkhead is to be employed, with four inches of air-space between the bunkers and the magazines, and with provision for a good circulation of air through this space.

Improvement in powder has been accompanied by a like improvement in projectiles. With an immense propelling power behind and rigid steel armor in front, the metal between found itself in an awkward situation. Cast-iron shot was found to break up against armor like a snow-ball, and wrought-iron projectiles flattened against the hard surface like so much lead. The armor-plates suffered little, the energy being spent on the projectile. The first step out of this difficulty was made by Captain Palliser, who succeeded in hardening the front portion of a shot by chilling, with the result that shot of this kind were able to penetrate wrought iron without breaking up or flattening. These shot are of cylindrical shape, with a pointed head, which acts like a punch upon the armor, into which it is pushed by the energy of the shot behind. These shot have the advantage of cheapness, and would still be of use against thinly armored ships, but steel shot are needed to penetrate the armor now made.

The projectiles now used with rifled cannon are in great part shells. In old times these were of cast iron, spherical in form, with time-fuses for their explosion.

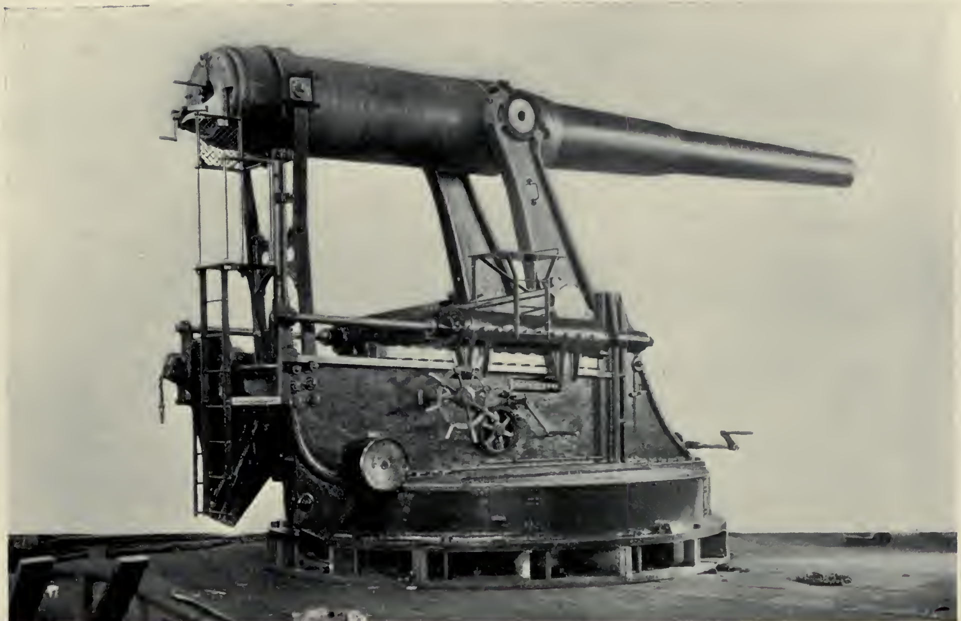
Those used in rifled cannon are of elongated and cylindrical form, and as their revolving movement gives assurance that the conical end shall strike first, they can be used with percussion priming, which explodes the shell on striking the object at which it is aimed. They are loaded with powder or some of the high explosives now in use, the shells employed for the latter having thick walls and small loading chambers. Gun-cotton is most commonly used for this purpose, it being considered the most reliable of the high explosives. Efforts are now being made to retard the explosion of armor-piercing shells, in order that they may penetrate more deeply before the explosion takes place, the hope being entertained that by such retardation, and the use of explosives of higher power, greater damage to the plate may result and the gun regain some of its lost supremacy.

The heavy guns now used in the United States navy, as has been already indicated in the preceding pages, are of 10-, 12-, and 13-inch aperture, their weight in tons being respectively 27.6, 45.2, and 60.5. It is well to state here that in British practice the grade of guns is indicated by their weight in tons, in American by the diameter of the bore. Of these guns, the 13-inch is forty feet long, its charge of powder weighing five hundred and fifty, its projectile eleven hundred pounds, while the muzzle velocity of its projectile is two thousand one hundred feet per second, and its penetrating power 34.6 inches of wrought iron, equivalent to about half that thickness of steel. The heaviest guns used in fortifications in this country are of 16-inch caliber, the heaviest abroad 17-inch. Of these, the American 16-inch gun, of one hundred and forty

tons weight, is heavier than the 17-inch gun of European forts.

Reference has already been made to the dynamite cartridge, discharged from the pneumatic gun, which constitutes the weapon of two of our war-vessels,—the Vesuvius and the recently purchased Buffalo (the Brazilian Nictheroy). The projectile of this gun is really a huge flying torpedo, charged with dynamite, and intended to produce its effect on the upper works of a vessel instead of upon the lower hull, as in the ordinary torpedo. For the 50-foot gun, of 15-inch caliber, the charge is five hundred pounds of dynamite. This can be sent with fair aim the distance of a mile and a half, and an 8-inch projectile, with one hundred pounds of dynamite, is calculated to do good service at two miles. The claim is that the dynamite shell does not need to strike a ship, but that if it struck the water within thirty yards and exploded, no ship could live in the awful concussion produced. But accurate practice with this gun is difficult and dynamite itself a treacherous substance to handle, and there seems no inclination to arm any other vessels with this gun. No nation of Europe has adopted it.

The locomotive torpedo has had many more years of development than the Zalinski dynamite tube, and has been taken up with avidity by all maritime nations, though its effect is in a somewhat similar position of doubt. There is no doubt, indeed, as to its destructive character, but the means of defence against it, as already stated, have become so developed as to rob it largely of its terrors. The development of the automobile or self-propelling torpedo was due to Mr.



TEN-INCH DISAPPEARING GUN—FIRING POSITION.

Whitehead, an English civil engineer residing in Austria, and owed its original suggestion to the danger attending the use of the spar or outrigger torpedo, the kind employed in the Civil War. The risk of discovery when close to the vessel to be attacked was so great that inventors began to consider the possibility of discharging a torpedo from a boat at a moderate distance. The original conception was that of a small sort of boat with mechanism to propel it for some distance along the surface and carrying in its bow a charge of gunpowder, to be exploded on contact. This idea was broached by an Austrian officer to Mr. Whitehead, and from it he gradually evolved the intricate piece of mechanism now known by his name, and which has become a part of the armament of all the navies of the world.

In the development of his conception the inventor had several things to consider. First of these was the mode of propulsion. For various reasons neither steam, electricity, nor gunpowder was suitable, and he finally fixed upon compressed air, which was to operate a small engine and turn a screw in the rear of his device, which he proposed to use as a small self-moving screw vessel. He next felt it necessary that the torpedo must play the part of a fish, moving under water. An explosion on the surface, against the water-line of a ship, would be of little advantage, since most of the gas yielded by the gun-cotton would escape into the air. If submerged, the water would confine the gas, and all its force be exerted on the ship. A charge of sufficient size would rend open the strongest vessel ever built.

It was necessary, therefore, not only to make the

torpedo move under water, but to prevent it rising to the surface through its buoyancy, which would increase as the compressed air lost density through escape of that portion working the engine. This difficulty was overcome by an ingenious contrivance, in which Mr. Whitehead utilized the pressure of water at different depths to control horizontal rudders, so that a sinking torpedo might be steered upward and a rising one be steered downward.

The Whitehead torpedo became, therefore, a contrivance of three chambers, one holding the engine, a second the tank of compressed air and a buoyancy section, and a third the explosive, originally gunpowder, but now the more powerful gun-cotton, of which a much lighter charge needs to be used. The ignition is effected by the impact of the nose of the torpedo against any hard surface, the result being to force a pointed striker against a detonating cap connected with the charge.

The torpedo thus constructed is a fish-shaped body of steel or iron capable of moving at a depth of from five to twenty feet under water, at high speed for a short distance, or for a greater distance if the speed be reduced. Mr. Whitehead's invention demonstrated its efficiency so thoroughly on trial that it was quickly adopted by nearly every maritime nation. The only adverse criticism that could be offered was its slow speed, which at first was about eight knots. If discharged at a vessel at a considerable distance it might very readily be swerved from the exact direction in the time needed, or lose its aim through change of position in the vessel aimed at. It was greatly improved when the speed was increased to eighteen knots by

using a three-cylinder air-engine, while the reduced weight of gun-cotton as compared with gunpowder permitted a smaller torpedo to be used. As thus improved, it was fourteen feet long, its largest diameter being fourteen inches. Its total weight was about five hundred pounds. Later improvements brought the speed up to twenty-seven knots for a distance of six hundred yards. It now carried a charge of sixty pounds of gun-cotton, equivalent to about two hundred pounds of powder. No ships, as then constructed, could have withstood the explosion of such a charge. As a defence against it the double-bottom system was extended, and the suggestion was made that the bottoms of ships might be protected with armor. But these defensive efforts would be useless against the torpedo in its present development, its speed having been increased to thirty knots, its diameter to eighteen inches, and its charge to two hundred and fifty pounds of the explosive. If necessary, the weight of gun-cotton could be still further increased.

Not only torpedo-boats and destroyers, but battleships and, to some extent, cruisers are equipped with launching tubes, two to four in number, for expelling these dangerous self-moving projectiles. The tube needs but little strength, and is only of the length necessary to contain the torpedo. As the latter is smaller at the ends than in the middle, a light framework of wood is built around it in the bore to keep it aimed correctly. It may be ejected by a small charge of powder, a jet of water, or a little compressed air, the first of these being usually employed in American practice. It is only necessary to get it out of the

tube in the proper direction. The discharge sets its machinery in operation, and this will do the rest.

Most of our large ships of war are equipped with the Whitehead torpedo, but in some cases the Howell is employed. This is an American invention, produced by Rear-Admiral Howell, of our navy, in 1871. It is similar to the Whitehead in appearance, yet entirely different in its motive power. A very heavy fly-wheel is contained within the shell, which is set spinning at the high velocity of ten thousand revolutions a minute by a suitable motor just before the torpedo is discharged. No engine is needed within the shell itself, the stored-up energy of the wheel being sufficient to turn the propeller screws and drive the torpedo at a high rate of speed towards the ship aimed at. The revolving wheel also serves to keep the motion uniform in direction, it acting on the principle of the gyroscope.

The latter principle is now adopted in the Whitehead torpedo, as manufactured for the American navy in the large torpedo factory at Brooklyn. Neither current nor obstruction can turn one of these improved torpedoes out of its course, the gyroscope acting forcibly on the rudder to bring it back to its proper direction. It can be prevented from making a lateral variation of more than three yards in eight hundred, the distance for which it is set. There are also devices to prevent premature explosion, and to render the torpedo practically harmless if it should miss its mark.

The depth of the torpedo is now regulated by pendulum motion. If it should turn downward, a backward swing of the heavy pendulum would act on the rudder

to bring it up. If it should tend to rise, the opposite swing of the pendulum would prevent. These torpedoes are thoroughly tested in Peconic Bay, Sag Harbor, Long Island, over a course of one thousand yards. A final test is made at the government station at Newport, Rhode Island, where several practice runs are given the torpedo. Not until it has been thoroughly proved is the charge, two hundred pounds of gun-cotton, put in.

The actual utility of the automobile torpedo in war remains to be demonstrated. A statement has been made by Mr. H. W. Wilson of the result of twenty-seven actions in which it has been used. It appears that out of twenty-one ships attacked when at anchor, twelve were sunk. On the other hand, there is not a single instance in which a ship in motion has received the slightest damage from a torpedo. The first attempt of this kind was made by the British ship Shah against the Huascar, and at the battle of the Yalu one of the Chinese ships discharged nearly all its torpedoes without the least injury to the enemy. During the revolution in Chili against President Balmaceda the torpedo-boats Almirante Lynch and Almirante Condell attacked the ironclad Blanco Encalada at anchor, taking her completely by surprise. They approached within three hundred yards, and each discharged two torpedoes, none of which struck the ship. Then the Lynch turned and passed the Encalada within fifty yards, discharging another torpedo, which struck the ironclad amidships. The shock was tremendous, the vessel heeled over, then rolled back, and the water poured into the large gap made in her bottom. She sank within five minutes. This torpedo was one of

small size, carrying about sixty pounds of gun-cotton.

In the latest naval war, that between Spain and the United States, the torpedo-boat failed to prove its efficacy against the search-light and the rapid-fire gun. Of two which attacked Admiral Dewey's fleet at Manila, one was riddled and sent to the bottom and the other barely escaped the same fate. At Santiago de Cuba vigilance on the part of the Americans prevented an attack by the Spanish torpedo-boats in the harbor.

The torpedoes described are intended for use from ships. There is another class, known as dirigible torpedoes, intended for harbor protection, they being sent off from shore, from which they are directed throughout their course by the aid of attached wires. Of these, there are a number of different inventions, as the Lay, the Brennan, the Sims-Edison, etc. The Lay torpedo, invented about 1872, is one of the earliest. This is a cigar-shaped craft, about thirty feet long and three inches wide, formed of iron plates, and water- and air-tight. It has three compartments, respectively for motive power, machinery, and electrical apparatus. Compressed carbonic acid gas serves for the motive power, it being sufficient in quantity to drive a pair of engines of eight horse-power for half an hour, during which the craft can traverse six or eight miles. The machinery is controllable by wires leading to a battery on shore, the cable containing the wires being paid out as the boat moves. By the aid of an electric current the throttle-valve of the engine can be controlled by one wire and the rudder by another. The vessel is almost completely sub-

merged, and, being painted green, is difficult to see at short distances. The magazine contains a large charge of powder or nitroglycerin, and in its forward part are explosive shells, which can be fired by an electric spark sent through a third wire in the cable. Two guide-rods, one at each end of the vessel, mark its position in the water, and it may by aid of the wires be steered directly against the vessel to be attacked.

The Sims-Edison, also of the steerable class, made its appearance about 1885. It is cigar-shaped, containing the explosive in its forward section, while the next section holds a cylindrical case in which is coiled an electric cable to be paid out as in the case of the Lay. In the centre is a little electric motor to drive the propeller screw, and the steering mechanism is in the after section. Its speed is about twelve knots. Above the torpedo is a long, buoyant float, from which rise little masts, bearing balls designed to aid the steersman on shore in directing its course, or small signal flags may be used by day and colored lights at night. The float is impenetrable to machine-gun balls. The cable is extremely flexible, about two miles in length, and contains an outer and an inner conductor, the first of which conveys a current for driving the motor in the torpedo, while the current in the other excites the magnets which control the steering gear. In a trial in 1891 it attained a speed of twenty knots. It is capable of carrying five hundred pounds of explosives.

The Brennan torpedo carries inside it two drums on which are wound piano wire. This passes out of the rear of the device and is connected with powerful engines on shore. When these are started, the wire is

reeled off the drums and on to large drums on shore, the motion of the drums in the torpedo revolving two screw propellers, which drive the craft through the water. Steering is effected by winding on one drum faster than on the other, this moving the rudder of the torpedo in the requisite direction.

The Victoria torpedo is somewhat similar to the Sims-Edison, but differs from the latter in being entirely submerged below the water and in using air as its motive power. When it is started it hauls a cable after it, unwinding it off a reel on shore, and the first part of its course is covered at a moderate speed. When the operator has guided it to within striking distance of the enemy a current is sent through the cable, which releases the reel on the torpedo and allows its end of the cable to unwind. At the same time the current starts the air-engine at full speed and the final dash for the ship is made. It has a pendulum mechanism to preserve its balance.

The Patrick torpedo is of large size, forty feet in length, and is driven by carbonic acid gas, it being maintained at the desired depth by a buoyant float on the surface. A cable of two wires connects it with the shore, from which, as in the case of the others named, it can be steered, and exploded at the right moment. The Nordenfelt torpedo uses an electric motor supplied by a storage battery as its source of power. It is supplied with two floats, which keep it at a depth of six to eight feet. The Hall torpedo resembles the Whitehead in its use of compressed air as a motive power. It has a telescopic tube to regulate its depth and a righting valve. The telescope tube can be thrust out into the water or withdrawn into the

1, bottom mines; 4, anchored mine with tidal adjustment; 5, fish torpedo; 6, Sims-Edison torpedo directed by wire.

torpedo, making it lighter in the first instance by increasing its air capacity, while in the latter it reduces the buoyancy of the apparatus.

The latest of these devices, the Halpine torpedo, an American invention, is a cylindrical apparatus of copper, twenty-four feet long and two feet in diameter. Its power is derived from storage batteries, which are capable of giving it a twelve-mile run. Two wire cables, each two and a half miles long, are coiled inside, and uncoil as it moves, connecting the craft with the operator on shore. It shows only three inches above water and can be sunk to fifteen feet, it being visible at night by two lights, which reflect backward so as not to be seen by an enemy, and which advise the operator of the position and direction of movement of the sunken craft. The wires enable him to steer and otherwise control it. This torpedo has an apparatus for cutting through the protective netting around a vessel. From the stem there projects a long spar bearing in front a steel harpoon to pierce the net, while two expanded arms, by their pressure against the net, push the spar back, strike the tripper, and set in train a mechanism which quickly explodes the charge. The boat can be drawn back out of danger, leaving behind the harpoon, which clings to the net by a hook-like arrangement, and its connective torpedo. The speed of this craft is nineteen knots per hour.

As may be perceived from the foregoing description, invention has been busy in devising apparatus of this character for harbor protection. These contrivances, too, seem capable of use from ship-board, though they are not likely to replace the automobile torpedo for that purpose. There is no instance on

record of their practical use in harbors, the land battery and the submarine mine being at present depended upon for harbor defence. With a description of the latter, in the following chapter, we shall complete our account of the mechanical appliances used in modern naval warfare.

CHAPTER IV.

MINES AND FORTIFICATIONS.

THE idea of the planted torpedo appears to have originated with Robert Fulton, who, in addition to his experiments with submarine torpedo-boats and with drifting torpedoes, proposed the planting of torpedoes in river and harbor channels, anchoring them to the bottom, but leaving them buoyant enough to float at the requisite distance beneath the surface. These torpedoes were to be arranged so that they would explode when any heavy object floated against them. Later, the fuse was altered so that the torpedo would explode only from actual contact with a ship or through a current of electricity supplied by wires running to a suitable station on shore.

The activity in river and harbor naval service during the American Civil War rendered the torpedo a very useful means of defence, and considerable use was made of it by the Confederate authorities. In November, 1862, during the attempt to reach the rear of Vicksburg through the bayous, the iron-clad gunboat

Cairo was blown up by torpedoes made of whiskey demijohns. In the defence of Mobile Bay devices of this kind were abundantly employed, the Confederates anchoring across the channel forty-six torpedoes made of beer-kegs and one hundred and thirty-four made of tin, all fitted with percussion fuses. A pass, marked by a red buoy, was left between them for the use of blockade-runners.

One of these crude affairs sank the monitor Tecumseh, and it was fortunate for the rest of the fleet that they were so poorly made, for, as the ships dashed through them, after Farragut's profane but famous remark, their percussion primers could be heard snapping, but not one exploded. Subsequently several other vessels and boats were sunk by them, although active efforts to clear the channel had been made. There were other instances of the use of torpedoes during the war, the most prominent being the sinking of the Patapsco in Charleston harbor.

Since the era of the war the torpedo has made important progress, both as the floating torpedo and the fixed or submarine mine. The mine differs but little from the anchored torpedo. It is intended to lie on the bottom of a river or harbor, and is weighted for this purpose. Originally these mines contained gunpowder. Now, in common with the anchored torpedoes, they are charged with the more powerful dynamite or gun-cotton.

For harbor defence the submarine mine is now almost exclusively employed. The old methods of mechanical ignition have grown, in great measure, obsolete, being replaced by electrical devices. Of these, the construction of the "circuit closer" and the

"firing box," with other details, are department secrets, while the plots of the torpedo-fields of various harbors are kept in the secret archives of the War Department, not to be trusted even to the engineers until the time to lay the torpedoes arrives.

There are two general classes of submarine mines in use,—the electrical contact and the self-acting or automatic. In the latter the charge is ignited on contact by the medium of a small battery of galvanic cells. These mines are equally dangerous to friendly and hostile ships, and they are used only in times of urgency or to supplement the other class. Their simplicity of structure, and the rapidity with which they can be laid, are at times of advantage; but they are apt to lose their efficiency if long laid, they cannot be tested, they threaten all ships, and they can be removed only by explosion. For these reasons they are likely to become obsolete.

The other class of mines has two varieties, the observation mine, which is fired from the shore when a hostile ship is seen in the desired position, and the electrical-contact mine, which, when struck by a ship, gives notice to the operator, who can explode it by pressing a button.

Generally speaking, the mine consists of a steel shell of comparatively light plating, which is filled with a charge of high explosive, usually gun-cotton, and contains at its base some exploding or detonating device for setting it off. For purposes of firing, cables are led from the igniting charge to an observation station, conveniently located on shore. The mines are built in a variety of shapes, some being cylindrical, with rounded ends, and others conical, with bulged sides.

The observation mines possess considerable advantage from the comparative simplicity of their construction and the fact that when they are laid they may be adapted to allow the passage of friendly vessels while barring those of a hostile power. When they are placed on the bed of a river or harbor they are known as ground mines. In some countries this type is of the cheapest construction, consisting of a rough cast-iron case, with projecting legs to enable it to anchor itself securely in the mud. There is practically no limit to the size of these mines. Lying deep down beneath the surface they are not liable to be laid bare with the fall of the tide, and they contain sufficient explosive to insure that any ship within a radius of fifty feet will be destroyed.

Observation mines may be fired by one or two observers. If by one observer, the mines are laid down in rows, the lines of which converge to the observation point. All the lines in one row are connected so that they can be simultaneously fired when the ship is passing the range line. When the mines are connected with two observers, they are laid according to a system of cross observation, by which it is possible to fire any particular mine when the ship is above or in close proximity to it. For this purpose the "range-finder" is employed, theodolite observations being taken from two stations separated by a considerable interval. The stations are connected by electric wires, which also connect them with the mining casement, so that the firing officer can be advised of the exact moment to discharge the mine. Of course, in times of fog, or when battle-smoke obscures the water, this

method cannot be employed, and contact firing becomes necessary. At night the search-light is used.

In the electrical-contact mine the apparatus is very delicate and complicated, and great skill and judgment are needed in its use. These mines are provided with automatic circuit closers, by means of which, on the mine being struck by a vessel, a current is sent to the observing station, from which the operator fires the mine. In one form of contact mechanism a vertical pendulum is hung in such a position that when the mine is struck it will swing over and close the circuit by striking a contact point. It will be noticed that in this system a friendly ship can be allowed to pass, even after it has struck the mine, the operator not heeding the signal; at the same time he could immediately control the mine to destroy a hostile ship.

The priming fuse employed is usually fulminate of mercury. This fits into a receptacle holding one pound of dynamite, the explosion of which causes the discharge of the whole. The unit of arrangement of a series of harbor mines is a group of twenty-one, which is divided into minor triangular groups of three. To each of these one of the cores of the cable runs, so that at no time can less than three be discharged from the shore. A chart, on which the whole is plotted, lies before the operator, and the wire running to each triangular group is clearly indicated.

Any one of the mines can be discharged independently by concussion from the vessel, the touch of a ship ringing a bell in the mining casement and breaking the circuit for five seconds, so that only the mine in contact is discharged. If the contact is too light to

cause an explosion, the bell warns the operator, who by a touch can set off the three mines.

These mines can be tested accurately in all their details, and kept at all times in perfect working order. The testing never ceases, the mine telegraphing ashore its condition and that of all its apparatus. Any fault can be located by electricity, delicate apparatus being employed, in which the galvanometer is the most important element.

The shape of the torpedo-case for the buoyant mines of the United States service is spherical, two hemispheres being welded together at their flanges. Steel is the metal used, it being made as thin as possible. In deep water—over seven fathoms—this form of mine is employed, it being anchored by a cable of such length that it will float at the required depth. It has the advantage of lying closer to the object of attack and not needing so heavy a charge of explosive material. The ground mine, which is used in shallower waters, is hemispherical in shape, its flat side lying on the bottom. It needs a much heavier charge of explosive. Above it floats its buoy, an empty sphere, held so that it will float from ten to twenty feet below the surface of ebb-tide. Telegraphic information comes to the operator on contact with this float.

Mining naturally leads to countermining. Boat parties may be sent in from a hostile fleet to take up floating mines or the contact closers of ground mines, or to cut the electrical connections, or heavy charges of dynamite may be exploded over a suspected field, for the purpose of setting off its mines by concussion. On the other hand, a patrol of launches, armed with machine-guns, is provided for defence, while the firing

stations on shore are made bomb-proof, and the observation stations are established in as remote and concealed situations as possible, that the operators may not be driven away or killed by the enemy's fire.

The latest and most terrible example of the frightfully destructive powers of the submarine mine is that of the sinking of the Maine in Havana harbor, February 15, 1898. Of the size and character of the mine to which this disaster was due we know nothing, its fragments being probably buried deep in the mud of the harbor, but the utter wreck it made of the battleship is an object-lesson of the most startling kind concerning the powers of these terrible contrivances. By their aid the harbors of the future will be rendered practically secure against the ships of an enemy, unless some means be invented to rob them of their sting.

Harbor defence is, of course, not intrusted solely to the mine. The battery is an equally important element, a very difficult one to overcome, in fact, since it can employ heavier guns, of longer range, and more securely protected, than can be handled in any ship. In the United States the frontiers exposed to attack are very largely maritime, and for defence not only ships and mines must be provided, but forts and batteries as well. And these fortifications are necessarily of a character very different from the coast defences of the past, when stone walls were trusted to keep out the heaviest cannon-balls that could be hurled against them from the decks of ships. The rifled cannon has had as great an effect upon the fort as upon the ship, the stone entrenchment has suffered the fate of the "wooden wall," and iron and steel are taking the place of masonry in places where earth,

1, bottom mines; 2, anchored mines; 3, anchor; 4, anchored mine with tidal adjustment; 5, fish torpedo; 7, Holland boat discharging torpedo; 8, ram Katahdin.

in sufficient thickness, cannot be employed. Fort Sumter, one of the strong masonry defences of the Civil War period, was quickly battered into a heap of ruins by Confederate fire from the shore. And in 1863 a group of five monitors bombarded it with like effect, silencing the fort and shattering its walls in a few hours.

This was the work of smooth-bore guns. With modern rifled cannon such a fort would have but a brief span of existence. Either earth or steel must now be depended upon. Former forts were built like former line-of-battle ships, with their several rows of port-holes for broadside fire. The guns were mounted in casements of masonry built tier over tier, with the design of pouring a crushing weight of metal upon any attacking fleet. This system has been discarded. It would be worse than useless in dealing with modern artillery. In 1886 a board of naval engineers recommended for the sea-coast defence of the United States a system of steel-plated turrets, armored casements, barbette batteries, mortar and floating batteries, and submarine mines, and our recent coast fortifications have been built on the lines of this recommendation.

The walls of a fort present a far easier problem for armored defence than the sides of a ship. The question of buoyancy does not need to be considered, and it is possible to make the armor of quite impenetrable thickness. At first armor-plates like those used on ships were placed on the walls of forts, but these were afterwards replaced by chilled iron armor of greater weight than any ship could carry. In many instances the armored turret was employed, the guns being stationary, the turret revolving, so that the projectiles

could be hurled in any direction. These turrets, which, like the parapets, are covered with thick armor of chilled iron, were at first made like those used on ships, but afterwards the cylindrical form, with flat or arched top, was abandoned, and the Gruson cupola turret adopted, a form in which no flat surface was shown. This turret is like the section of a sphere, rounding upward in all directions, so as to deflect upward any projectile that may strike its surface.

As only long cannon for direct fire can be employed in turrets of this kind, cupolas of a different kind were provided for mortars and howitzers. For the shorter mortars the cupola is contracted to a sphere enclosing the mortar. The next step in the evolution of the turret was the introduction of disappearing turrets, which gave greater safety to the gunners than those that simply revolved to turn their port-holes away from an enemy. These were intended for small or medium-sized guns, but subsequently were built in France for heavier guns. In these the cylindrical moving part has a sinking as well as a revolving motion, and can be lowered until its arched top is on a level with the glacis, allowing the guns to be loaded without danger from the enemy.

In many cases overhead covering to the fort is not deemed necessary, and in these instances the barbette turret is adopted, the guns being lifted above a stationary ring of armor, over which they fire. In this case the gunners are protected by a shield of metal connected with the carriage. In other cases the disappearing carriage is employed. In this instance the gun, when loaded, is raised by a pneumatic or other device, appears at an opening in the roof, which is

kept closed until the proper time, and delivers its fire. The recoil of the gun carries it back automatically to the protected position, for reloading. Armored fortresses, of some of the kinds mentioned, now exist on the coasts of all civilized maritime countries, the chilled iron turrets being preferred in some European countries, the disappearing carriage in the United States and England.

The development of a satisfactory disappearing carriage constitutes a problem that has given no little trouble to engineers. One of these was proposed as long ago as 1775, by Corneille Redeichkeit. It was a cumbrous system, depending on cords and counterweights, and quite likely to get out of order, and was soon abandoned. Other inventors employed eccentric trucks and axle-trees, but in this way could not raise the gun far enough above the loading position. Then a twin-gun system was proposed, two guns being joined by ropes, so that as one sank to the loading the other was lifted to the firing position. General Chasseloup worked for thirteen years upon this conception, but failed to make it act satisfactorily. The Moncrieff counterweight carriage was the next introduced. In this the recoil, while forcing the gun downward, lifts a heavy counterweight. When ready to fire this is set free, and its weight raises the gun to the firing position. The objection to this system is the great weight of the accessories. The Moncrieff carriage, however, has been widely adopted in Great Britain. The systems invented in this country, by Eads, Buffington-Crozier, and others, are mostly based on the Moncrieff idea of a counterweight.

Of American inventions, one of the most recent,

the Gordon disappearing carriage, was subjected to an official test in 1894. Ten shots an hour were called for by contract, but it proved capable of delivering thirty-two shots in that time. When in firing position the gun is raised twenty feet above the ground. It is dropped eight feet to load, the recoil being taken up partly by air pressure, partly by counterweights.

The Buffington-Crozier carriage, which has been adopted by the United States government as the standard type for coast-defence fortifications, is somewhat lighter than the Gordon and has stood very severe tests. In this also a counterweight is used, which takes up about one-third of the recoil, the remainder being taken up by two hydraulic cylinders. The counterweight for an 8-inch breech-loading rifle weighs about thirty-two thousand pounds. The gun is carried upon supporting levers, pivoted upon a strong steel axle, which permit an easy movement of ascent and descent. The gun is aimed while lowered, and during the few seconds of its elevation to fire would be a very difficult object to hit. The mechanism acts with great rapidity, as many as ten shots having been fired in a little over twelve minutes from an 8-inch gun.

This device gives almost complete protection to the guns of a land fortification. A gun in an ordinary barbette offers an inviting object for an enemy's fire, and if hit might be dismounted and the gunners disabled or killed. The disappearing gun is exposed only at the instant of firing, and its gunners not at all, so that the risk is reduced to almost nothing. A fort provided with guns of this character and properly armored can defy the fire of an attacking fleet, while

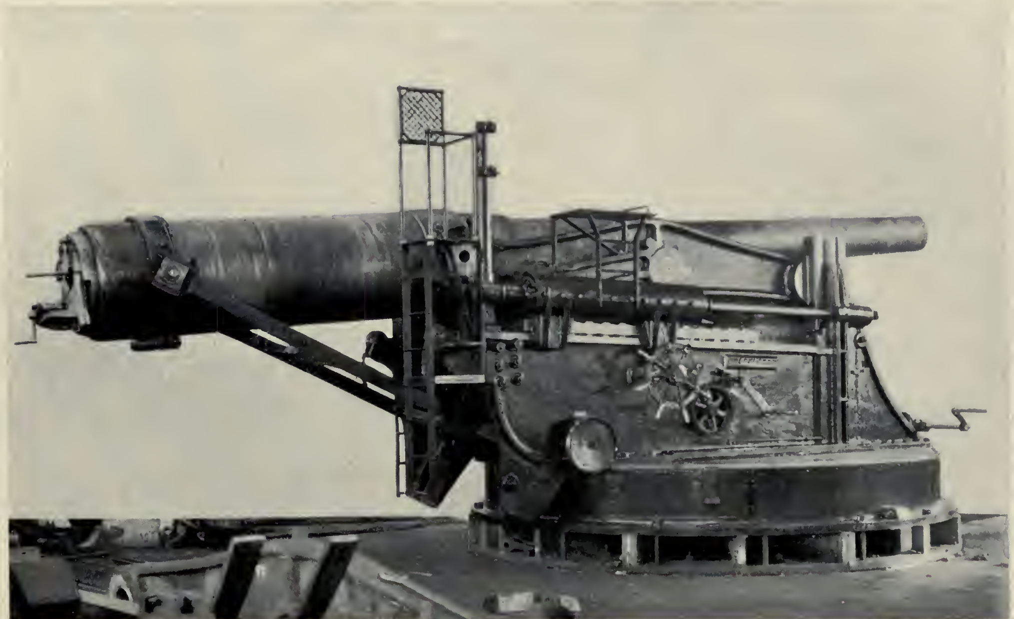
the latter would be a fair target for its rapidly rising and sinking guns.

Upon sea-fronts the works of defence consist generally of isolated forts, separated by considerable intervals, depending upon the conditions of the channel. Smaller batteries may occupy positions between. At the entrance to the bay of New York, on Sandy Hook, are earthworks provided with disappearing guns, and similar defences have been provided at other points commanding the channel. These batteries are provided with 10- and 12-inch rifled cannon, a number of 12-inch steel mortars, and some dynamite guns. Across Romer Shoal it is proposed to erect four steel turrets, set on steel piling in the most substantial manner, masonry protecting the metal from corrosion by sea-water. The turrets will be circular and revolving, heavily plated, and each carrying two guns of the largest caliber, while a number of 6-inch and 8-inch rapid-fire guns will also be provided. The magazines, machinery, and quarters for the men will be located below water-level, behind a thick bank of sand. The guns of these turrets will be able to sweep all approaches to New York, and it would be very unsafe for any hostile fleet to come within their range.

The aim from a land battery is much surer than from a ship, and any such fleet would stand serious risk of injury in approaching fortifications of this character. While a 13-inch gun is the largest that can practically be used in a ship, some of our land forts carry 16-inch guns, of one hundred and forty tons weight. The charge of these guns weighs one thousand and sixty, their projectiles two thousand three hundred and seventy pounds. Even when miles away, the most

powerful ship would be in danger of this ton and more of steel being plunged against its side or upon its deck, with a penetrating force that few armor-plates could resist. Even the smaller 12-inch guns, of the class used in our forts, are capable of sending, near the muzzle, their 1000-pound steel projectile through thirty-six inches of wrought iron, and more than half that thickness of steel.

Something may be said in conclusion regarding the cost of equipping a modern fort and battle-ship with guns and ammunition. Secretary Long estimated that each of the 10-inch guns sunk with the Maine had cost the government $43,000. The 12-inch gun is worth perhaps $10,000 more, and the 16-inch gun, which class has been very sparsely made, is worth not less than $175,000. And these guns are not made for all time. It is said that after three hundred shots they must be sent back to the factory to rebuild, and that double this number of shots would render them useless. If these facts be taken in connection with the cost of the great steel shell and heavy powder charge consumed in each explosion and the $400 per ton cost of the armor-plate, it will be seen that naval warfare and coast defence, as now conducted, need a very heavy purse or a very short war.



TEN-INCH DISAPPEARING GUN—LOADING POSITION.

CHAPTER V.

THE NAVIES OF THE NATIONS.

We cannot justly compare the fleet of the United States with those of the powerful maritime nations of Europe. Those of Great Britain and France have been forty years in building, and those of some other nations nearly as long, while almost the first step towards our existing fleet was taken but fifteen years ago, and ten years ago we possessed only a few second-rate cruisers of modern type. Since that period highly encouraging progress has been made, and this country is likely within the near future to take rank with the chief naval powers of the world. With this preliminary statement we propose to give in brief the naval strength of the maritime nations, as a means of estimating their relative position in regard to sea-power at the present day.

At a low level among the navies of the larger nations stands that of Spain. But at this present writing it occupies the most prominent position in the world's eye, with the exception of the navy of the United States. We shall begin, therefore, with a succinct roll-call of the Spanish ships of war. In the war with the United States the navy of Spain became divided up into three fleets, that of the Philippine Islands, that of the West Indies, and that of Cadiz. The first of these no longer exists, and we can but tell what it was, not

what it is. The guns of Admiral Dewey's fleet have given it a resting-place on the bottom of Manila Bay.

The Reina Cristina, Admiral Montojo's flag-ship, was a single-screw cruiser of 3090 tons displacement, and a length of two hundred and eighty feet, her armament consisting of nineteen slow- and rapid-fire guns, two machine-guns, and five torpedo-tubes. The Castilla was a cruiser of 3341 tons displacement, armed with several 5.9-inch and 4.7-inch Krupp guns and a secondary battery. There were four other small cruisers,—the Don Antonio de Ulloa, of 1152 tons, the Isla de Cuba, 1040 tons, the Velasco, and the Isla de Luzon, with lighter armament than the Reina Cristina and the Castilla. The gunboats included the General Lezo, the Marques del Duero, and the El Correo, each of about 500 tons, and armed with 4.7-inch rifles and machine-guns. The Isla de Mindanao was a transport of 4195 tons.

Admiral Cervera's fleet, at first known as the Cape Verde and later as the West India Squadron, had for flag-ship the armored cruiser Cristobal Colon, of 6840 tons displacement and three hundred and twenty-eight feet in length. Her armor consists of a complete belt of 6-inch nickel steel, and a protected deck from two to eight inches thick. She has two barbettes, protected by 6-inch armor, and an armament of two 9.8-inch, ten 6-inch, and six 4.7-inch guns, with a powerful secondary armament of 6- and 1-pounders and machine-guns. Her speed is twenty knots.

This fleet contains three other armored cruisers,—the Vizcaya, of 6890 tons, 20.2 knots speed, 10- to 12-inch armor, and a powerful armament, including two 11-inch and ten 5.5-inch guns, and numerous smaller

guns; the Almirante Oquendo, a double-turreted steel ship similar in tonnage, armor, and armament to the Vizcaya; and the Infanta Maria Teresa, also identical in all particulars with the Vizcaya. The fleet also embraces the protected cruiser Reina Mercedes and three torpedo-boat destroyers, the Terror, the Furor, and the Pluton, steel craft of about 320 tons displacement and twenty-eight knots speed, each carrying two 14-inch torpedo-tubes and armed with a number of rapid-fire guns.

The make-up of the Cadiz fleet, under Admiral Camara, is somewhat problematical. It embraces the first-class battle-ship Pelayo, of 9900 tons displacement, $17\frac{3}{4}$-inch armor-belt, 16 knots speed, two $12\frac{1}{2}$-inch and two 11-inch guns, with a number of large rapid-fire guns; and the Numancia and Vitoria, second-class battle-ships, of about 7300 tons. Its armored cruisers comprise the Carlos V. and the Cardinal Cisneros, of 7000 tons, and carrying two 11-inch guns. The Alfonso XIII., a protected cruiser, of 5000 tons, is armed with four 7.8-inch and six 4.7-inch guns. There are a number of other cruisers, principally in an unfinished state, a considerable number of gunboats and torpedo-boats, and several auxiliary vessels.

First among the naval fleets of the world stands that of Great Britain, embracing no less than twenty-nine first-class and twenty-four second-class battle-ships, seventeen coast-defence vessels, eighteen armored, and one hundred and twenty-six unarmored cruisers. In addition there are sixty-two gunboats and nearly three hundred torpedo-boats and destroyers. Many of these vessels are practically obsolete, having been built in the infancy of ironclads, and

provided with wrought-iron armor. The first-class battle-ships, however, are mainly of recent date and carry compound armor or Harveyized steel ranging in thickness from six to twenty inches, their protective decks being from 2½- to 4-inch thickness. Of these ships, twenty-five are of 12,000 tons or over, of which seventeen range over 14,000 tons. Their speed averages from about seventeen to eighteen and three-quarters knots and their coal endurance from seven thousand to eight thousand miles. The Centurion has an endurance of 10,000 and the Renown of 12,000 miles. Their main armament comprises guns of 12- to 13½-inch bore. The second- and third-class battle-ships are, as a rule, armed with muzzle-loaders, these being ships built at a date before the advantage of the breech-loading principle had made itself apparent to the British official conception, though other nations had long before adopted it.

France stands second as a naval power, her fleet embracing fifteen first-class and nine second-class battle-ships, twenty-four coast-defence vessels, thirteen armored, and sixty-one unarmored cruisers. Of gunboats she possesses forty-nine, and of torpedo-boats and destroyers over two hundred and sixty. Her battle-ships range below those of Great Britain and resemble those of the United States in size, the largest being the Formidable, of 12,165 tons. We need scarcely repeat what has been already said, that the larger displacement of the British battle-ships is no indication of greater strength, its principal advantage being in superior coal-carrying capacity. The armor of the French battle-ships ranges from 14- to 21½-inch steel in its thickest regions, several ships

having side armor of the latter thickness. The larger guns vary from 12- to 13.4-inch. The speed of these vessels varies from thirteen and a quarter to eighteen knots.

Next on the list in number of first-class battle-ships stands Russia, with fourteen vessels of this class and four of lower class. She has in addition twenty-eight coast-defence vessels, fourteen armored, three protected, and twenty unprotected cruisers. Her gunboats number fourteen, and her torpedo-boats and destroyers two hundred and thirty. Her first-class battle-ships vary from 9476 to 12,674 tons, with speeds ranging from fifteen to seventeen and a half knots, and side armor of from 9- to 16-inch steel,—18-inch in one instance. Her largest guns are of 12-inch aperture, several of her ships carrying four 12-inch and eight 8-inch guns.

Germany has a fleet of six first-class and ten second-class battle-ships, with nineteen third-class or coast-defence vessels, seven armored and nineteen protected and unprotected cruisers, three gunboats, and nearly two hundred torpedo-boats and destroyers. Her first-class battle-ships range from 10,100 to 11,000 tons, and carry from 12- to 15¾-inch steel armor. Their speed ranges from fifteen to eighteen knots per hour. Their main armament, in most instances, comprises six 11-inch slow-fire and six 4.1-inch rapid-fire guns.

Italy is credited with eight first-class battle-ships and two of second-class, with seven sea-going coast-defence vessels. Her armored cruisers are eight in number, her protected cruisers twenty-three. She is credited with only two small gunboats, and with over two hundred torpedo-boats and destroyers. Several

of her battle-ships are of large displacement, two reaching 14,400 tons. The larger have protective armor of 16- to 21½-inch steel, their speed ranging from 15 to 20.2 knots.

The fleet of Austria includes ten second-class battle-ships, seven coast-defence vessels, two armored and ten unarmored cruisers, eight gunboats, and eighty-seven torpedo-boats and destroyers. Her battle-ships range from 5510 to 7390 tons displacement, with side armor of from 6- to 14-inch steel. Their speed varies from 13 to 17.2 knots.

The only other European nations possessed of battle-ships are Turkey, which has one of first-class and eight of second-class size, and the Netherlands, with three second-class battle-ships. Denmark has twenty-six sea-going coast-defence vessels, and the Netherlands twenty-four coast-defence ships, mainly non-sea-going. Each of these countries possesses a moderate number of cruisers.

Of the South American and Asiatic nations Japan stands first, with five first-class and two second-class battle-ships, six coast-defence vessels, four armored, and twenty-two unarmored cruisers. Her gunboats are nine in number, torpedo-boats one hundred and forty-seven. China's fleet at present, since her losses to Japan, includes seventeen unarmored cruisers, sixteen gunboats, and forty-six torpedo-boats. Of the South American nations, Brazil has two second-class battle-ships and ten coast-defence ships, Chili two of the former and one of the latter, and Argentina one of the former and four of the latter. They have, besides, small fleets of cruisers and torpedo-boats.

This review may fitly conclude with a condensed

statement of the naval force of the United States, by way of comparison. This includes (built and authorized) twelve first-class and one second-class battle-ships, two armored, fifteen protected, and three unprotected cruisers, seventeen single-turreted and six double-turreted monitors or coast-defence vessels, sixteen gunboats built and a number converted, and twenty-three torpedo-boats under contract before 1898, with a larger number authorized in that year.

As regards speed, the battle-ships of the United States stand at a somewhat low level, many of those abroad being two or more knots faster. This lack of speed, however, is made up by other desirable qualities, and if we accept the dictum, already quoted, that "a battle-ship is made to fight, not to run," our ships are strikingly well fitted for this primary duty. It is to cruisers that the quality of speed most properly belongs, and of these our navy possesses the two fastest upon the face of the deep, the nearest approach to the Columbia and the Minneapolis being in a few 22-knot British cruisers. In recent years great attention has been given to the building of torpedo-boats, a field of naval evolution into which the United States has just actively entered. Whether the activity of the nations in this line is not misdirected is open to question. So far the torpedo-boat has threatened far more than it has performed, and its service promises in the future to become so dangerous to its crew and ineffective in its results that only men to whom life is no object will be likely to engage in it.

THE END.